JPRS 79694

21 December 1981

USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 88

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CONTENTS

ANTENNAS

Statistical Characteristics of Adaptive Antenna Arrays With Constraints.. 1

Diffraction of Waves in Autocollimation Regime on Screened Ribbon Array of 'Louver' Type.................................... 1

Mathematical Models of Antenna Arrays and Techniques for Their Numerical Realization... 2

Algorithms for Solving System of Linear Algebraic Equations Encountered in Antenna Array Analysis.......................... 3

CERTAIN ASPECTS OF COMPUTER HARD AND SOFT WARE: CONTROL, AUTOMATION, TELEMECHANICS, TELEMETERING, MACHINE DESIGNING AND PLANNING

Algorithm for Checking Conformity of Designer Documentation to Electrical Schematic.. 4

Set of Multiple Target Function Optimization Algorithms for Linear Functional Units....................................... 5

Theory of Control of Active Mobile Objects........................ 6

One Basis for Determination of Dynamic Characteristics of Inertial Systems by Orthogonal Expansion Method................ 6

Calculation of Sensitivities and Influence Coefficients.......... 7

Algorithms and Programs for Digital Circuit Design Using Bipolar Transistors... 8

Utilizing Property of Macromodel Structure Orientation in Circuit Design With Equivalent Circuits........................ 8

Systems Vector Relaxation Technique for Multidimensional Numerical Analysis of Semiconductor Devices..................... 9

Some Possibilities of Optimizing Degree of Control in Radio Electronic Equipment....................................... 10

Organization of Industrial Information-Managing System Planning on Base of Mini- and Microcomputers............................ 11

Effective Realization of Adaptive Algorithms of Multicriterion Optimization Problem for Optoelectronics Computer.............. 11

Selection of Telemetric Information During Input to Computer...... 13

Control, Optimum With Respect to Resource Expenditure, of Dynamic Object.. 13

CERTAIN ASPECTS OF PHOTOGRAPHY, MOTION PICTURES AND TELEVISION

Computer Study of Acoustical Properties of Auditorium Designs..... 14

Organization of Monitors and Instrumentation in Large TV System Based on Example of Olympics Television and Radio Complex....... 14

Second Generation Integral Microcircuit for Line Scanning Generators... 15

Vidicon Operation With Nanosecond Exposures...................... 16

General Purpose Microcircuit of High-Speed Clock Pulse Shaper for Charge Coupled Devices.................................... 16

Television Techniques of Moving Image Analysis................... 17

Contemporary Trends in Development of Television--Motion Picture Equipment.. 18

Methods of Electronic Simulation of Game Situations in Television Simulators and Game Automata........................ 19

Fiber Optics Line for Portable Color TV Cameras.................. 19

Holographic Projection of Static Three Dimensional Images........ 20

CIRCUIT THEORY AND PRACTICE

Optimizing Electronic Circuit Parameters.......................... 21

Structural Circuit Design for Electronic Circuits................ 22

Modeling Electronic Circuits in Generalized Nodal Coordinate Base.. 22

Automated Study of Kind of Electronic Circuit Quality Functions... 23

COMMUNICATIONS, COMMUNICATION EQUIPMENT, RECEIVERS AND TRANSMITTERS, NETWORKS, RADIO PHYSICS, DATA TRANSMISSION AND PROCESSING, INFORMATION THEORY

Increased Effectiveness of Mechanical Cable Laying............... 25

Transit of Remote Signal Channels................................ 26

Industrial Methods of Constructing Radio Relay Lines............. 26

Measurement of Parameters of Individual and Periodic Radio Pulses.. 27

Consideration of Propagation Time of Packets With Random Multiple Access.. 28

COMPONENTS AND CIRCUIT ELEMENTS, WAVEGUIDES, CAVITY RESONATORS AND FILTERS

Theory of Prism Storage With Anisotropic Inhomogeneous Optical Waveguide... 29

Field Components, Energy Distribution and Attenuation of Basic Wave Types $E_{\parallel}^{x}$ and $E_{\parallel}^{y}$ in Rectangular Dielectric Waveguide With Dielectric Substrate.................................... 30

Binary Coding of Space-Frequency Filters for Coherent Optical Processor... 31

CONVERTERS, INVERTERS, TRANSDUCERS

Features of Technology for Producing Integrated Strain Transducers (Survey).. 32

Rotary Frequency Converter With Adjustable Autotransformer........ 33

Calculating Optimally Efficient Number of Individual Units Comprising Adaptive Voltage Converters......................... 33

Evaluation of Control Characteristics of Frequency Converter Operating in Autonomous System of Electric Power Supply......... 34

Using Regressive Analysis for Substantiation of Operational Control and Rejection System in Process of Producing Nonlinear Measuring Current Transducer.................................... 35

Balancing of Pulses in Phase Control System of Thyristor Converter.. 35

Coaxial Transducer of Decreasing Power........................... 36

Analysis of Dynamics of Integrating 'Voltage--Interval of Time' Converters With Intermediate Scale-Time Conversion.............. 36

Pulsed Electromagnetic Energy Conversion in Discharges When Using Inductive and Capacitive Energy Storage Devices........... 37

CRYOGENICS AND SUPERCONDUCTIVITY

Switchgear for Cryogenic Alternating Current Transmission......... 38

Femtovoltmeter Based on Josephson Effect........................... 39

ELECTRICAL ENGINEERING EQUIPMENT AND MACHINERY: APPLICATIONS AND THEORY

Dynamic Properties of Discrete Stabilized Power Source in Electric Motor Car... 40

Problems of Developing Electric Machine Methods for Pulse Power Generation.. 41

ELECTROACOUSTICS

Calibration of Acoustic Vector Receivers.......................... 42

Sound Field of Moving Source....................................... 43

Some Special Features in Designing Acoustic Device for Display Coordinate Meters.. 43

ELECTROMAGNETIC WAVE PROPAGATION, ELECTRODYNAMICS

Ionizing Deformation of Plasma Resonance Region in Strong Microwave Field.. 45

Form of Spectrum of Nonuniformities in High-Latitude Ionosphere in Direction of Geomagnetic Field.. 46

Modulation Transfer Phenomenon During Effect of Powerful Radio Waves on Ionosphere Plasma...................................... 46

Parametric Instability of Magnetosonic Waves in Plane Plasma Waveguide.. 47

Calculation of Three- and Two-Dimensional Quasi-Stationary and Static Electromagnetic Fields in Anisotropic Multilayer Cylindrical Media.......... 48

Constructing Active Electromagnetic Shields.......... 49

Quasi-Wave Method for Solving Problem of Electromagnetic Wave Propagation in Inhomogeneous Anisotropic Absorbing Medium.......... 49

ELECTRON TUBES: ELECTROVACUUM TECHNOLOGY

Investigation of Multiple-Resonator Klystrons, Optimum With Respect to Efficiency of Operation and Structure.......... 50

ENERGY SOURCES

Radio Moscow Reports Soviet Development of New Semiconductor Photoelectric Device.......... 51

GENERAL TREATMENT, INCLUDING POLICY DECLARATIONS, OVERALL STATISTICS, FORECAST OF TRENDS, 'THINK PIECES'

Ensuring Timely Completion of Communication Installations.......... 52

INSTRUMENTS, MEASURING DEVICES AND TESTERS, METHODS OF MEASURING, GENERAL EXPERIMENTAL TECHNIQUES

Resolution of Self-Adjusting Optical Displacement Meter.......... 54

Digital Modelling of Integral Method of Dynamic Error Compensation in Thermal Radiation Flow Measuring System.......... 55

MICROELECTRONICS

Properties of Integrated Circuit Components on Basis of GaAs.......... 56

Model of Field-Effect Transistor With Schottky Gate for Machine Planning of Super Fast Integrated Circuits Based on Gallium Arsenide.......... 57

Investigation of Characteristics of Analog Switch With MOS Structure During Switching of High-Frequency Signal.......... 57

Special Features of Photogeneration of Charge Carriers in MOS Structures Close to Edge of Metal Electrode.......... 58

Photosensitivity of Surface-Barrier Structure Based on Type $^{III}B^{VI}$ Laminated Compound.......... 59

Method of Determining Parameters of Microstrip Units.......... 60

OPTOELECTRONICS, QUASI-OPTICAL DEVICES

Lens for Reproduction of Phase Information........................ 61

Multistability in Optical Transmission of Spatial Modulation of Light With Internal Feedback................................ 62

OSCILLATORS, MODULATORS, GENERATORS

Pulse Width Modulator Designed Around Integrated Circuits......... 63

POWER SYSTEMS (INCLUDING EFFECT OF VARIOUS ITEMS ON POWER TRANSMISSION)

Complex Automation of Rural Electrical Networks.................. 64

Calculation of Crosstalk Attenuation Between Intraphase Channel and Phase-to-Ground Channel of 330 KV Power Line................ 65

Operation Under Voltage--Most Effective Method of 750 kV Overhead Line Operation.. 66

PRODUCTION TECHNOLOGY

Line for Soldering Radio Elements on Printed Circuit Boards by Flow Soldering.. 67

QUANTUM ELECTRONICS

Electronic Control Unit of Discrete Acoustooptical Deflector...... 68

Interview With Mikhail Ayrazatovich Kazaryan...................... 69

RADARS, RADIONAVIGATION AIDS, DIRECTION FINDING, GYROS

Secondary Radar System Principles, Improvements.................. 70

Comparison of Recurrence-Type Algorithms of Nonretrieving Correlational-Extremal Navigation Systems....................... 73

Using Two-Step Stabilization in Optical Direction-Finding Devices.. 74

Identification of Nonlinear Objects With Noise................... 74

Determination of Signal Forms Reflected From Complicated Objects.. 75

Search for Moving Signal in Multichannel System by Degenerated Sequential Analysis Method.. 76

SEMICONDUCTORS AND DIELECTRICS, CRYSTALS IN GENERAL

Using Vitreous Dielectrics in High-Temperature Resistance Strain Gauges.. 77

Lateral Magnetotransistor With Metal-Insulation-Semiconductor Structure.. 78

VARIOUS MISCELLANEOUS ITEMS, INCLUDING THEORIES

Algorithm of Search for Minimum of Function of Two Variables Without Calculation of Its Derivatives.......................... 79

Detonation Model of Pulsed Arc in Similarity Model Approximation.. 80

ANTENNAS

UDC 538.56:519.25

STATISTICAL CHARACTERISTICS OF ADAPTIVE ANTENNA ARRAYS WITH CONSTRAINTS

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 5, May 81 (manuscript received 27 Dec 79) pp 577-585

MAL'TSEV, A. A. and POZUMENTOV, I. Ye., Gor'kiy State University

[Abstract] In the present paper, the statistical characteristics were determined of an adaptive antenna array (AAA) with constraints, taking into consideration fluctuations of the vector of the weight coefficients. These characteristics are of great importance because, all things considered, they determine the limiting degree of suppression of noise and the precision of the selection of a legitimate signal. The AAA considered here maximizes the signal-to-noise ratio at the output of the system. However, the method of analysis employed can also be used for an AAA, operating according to the criterion of the minimum mean square error. A two-element AAA with a single-stage constraint is considered as an example. The direction of arrival of a legitimate signal is assumed to be known and normal to the axis of the array. Also considered is the effect of fluctuations of the weight coefficients on the characteristics of a two-element AAA with constraints. Figures 3; references 8: 5 Russian, 3 Western.
[375-6415]

UDC 621.372.8

DIFFRACTION OF WAVES IN AUTOCOLLIMATION REGIME ON SCREENED RIBBON ARRAY OF 'LOUVER' TYPE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian
Vol 24, No 5, May 81 (manuscript received 12 Aug 80) pp 650-652

SHKIL', V. M.

[Abstract] Screened ribbon arrays of the "Louver" type find use in microwave techniques because they possess a number of the required diffraction properties. The present paper studies the spectral distribution of the intensity of polarized radiation during diffraction of waves at such an array in an autocollimation

regime, i.e., when the space harmonic with the number $n \neq 0$ is propagated inversely to the source of irradiation. Numerical results are obtained with a proposed ideal conductivity on the basis of a rigorously substantiated solution of the problem in question. An analysis of the numerical data shows that by a change of the geometrical parameters of the array it is possible substantially to change the nature of the redistribution of the intensity of the polarized radiation. In so doing the points of circular resonance are less sensitive to this variation. The author thanks S. A. Masalov for valuable critical comments. Figures 2; references: 3 Russian.
[375-6415]

UDC 621.396.67

MATHEMATICAL MODELS OF ANTENNA ARRAYS AND TECHNIQUES FOR THEIR NUMERICAL REALIZATION

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 6, Jun 81 (manuscript received 20 Oct 80) pp 15-26

GOSTYUKHIN, V. L., GRINEVA, K. I., KLIMACHEV, K. G. and TRUSOV, V. N.

[Abstract] Mathematical modeling techniques for finite, planar antenna arrays with a periodic configuration of the radiators can be broken down into four steps: 1) The choice of the manner of representation of the array radiation field; 2) The selection of the physical approximations for the construction of the mathematical model; 3) The mathematical formulation of the problem; and 4) The numerical realization of the mathematical models. This general review of such techniques from the Soviet and western press briefly surveys: The description of a radiation field using superimposition of the directional patterns of individual radiators; the representation of a radiation field in the form of an expansion in spherical harmonics; field representation in terms of equivalent currents in the array aperture; the physical assumptions made in writing the algebra for the boundary problem; and models of array radiators in free space employing matrix representations and an array model in the form of an infinite periodic structure. The survey does not pretend to completeness and despite the fact that mathematical modeling of such arrays deserves considerable attention, questions related to modeling reliability have not been studied: there are no estimates of the precision with which antenna system parameters are predicted (the level of sidelobes, overall gain, directional gain and input impedance of the radiators). Figures 2; references 40: 21 Russian, 19 Western.
[333-8225]

UDC 621.396.494

ALGORITHMS FOR SOLVING SYSTEM OF LINEAR ALGEBRAIC EQUATIONS ENCOUNTERED IN ANTENNA ARRAY ANALYSIS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 6, Jun 81 (manuscript received 28 Jan 80) pp 110-111

KHZMALYAN, A. D.

[Abstract] The integral equation for a finite equidistant linear antenna array which can be written for the current in its elements using Galerkin's technique is solved using a cellular greenhouse matrix for the system of linear algebraic equations (Kirchoff's equations). The matrix is written in terms of the mutual impedance between current harmonic in each element, the amplitudes of the current harmonics and the voltage exciting it in the elements as well as the number of elements N in the array and the current harmonics which are taken into account M. The algorithms for solving such systems require on the order of NM^2 store locations and N^2M^3 arithmetic operations; this is significantly more economical than traditional methods. A new algorithm is proposed which is predicated on the previous cellular greenhouse matrix approach, but requires only $(2N - 1)M^2$ store locations for the matrix data file in the general case. Further improvements for the case of an isotropic medium and the use of test functions which are symmetrical or antisymmetrical relative to the center of an array element are also discussed. The proposed algorithm is significantly more efficient than the algorithm for a system of linear equations with a cellular greenhouse matrix in gereral form. No sample calculations or experimental data are provided. References 3: 2 Russian, 1 Western.
[333-8225]

CERTAIN ASPECTS OF COMPUTER HARD AND SOFT WARE: CONTROL, AUTOMATION, TELEMECHANICS, TELEMETERING, MACHINE DESIGNING AND PLANNING

UDC 519.21

ALGORITHM FOR CHECKING CONFORMITY OF DESIGNER DOCUMENTATION TO ELECTRICAL SCHEMATIC

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 6, Jun 81 (manuscript received 22 Dec 80) pp 91-95

YEROKHIN, V. V., NOSKOV, Yu. M. and SYPCHUK, P. P.

[Abstract] The increasing complexity of printed circuit boards and LSI topology necessitates the automatic detection of errors in the designer documentation for such devices. The algorithms for the majority of known methods involve the reproduction of the basic electrical circuit's topology and the comparison of the resulting circuit with the original. This paper proposes the simpler and faster error detection method which uses a set of nonlinear equations for the mathematical model of the topology. The technique of describing the geometric objects approximates the route of a conductor with a set of interconnected horizontal and vertical segments. The contacts of components and contact areas for external leads belong to these segments, though they are not necessarily their end points. The raw data for the proposed method is a table of coordinates (nodal points), a table of tie points for the components and the basic schematic which makes it possible to determine the actual coordinates of component contacts from their tie points. The method is applicable to both single and multilayer designs and employs the standard set of design documentation, which is obtained either manually or automatically. Models can be constructed with the method which describe the actual paths (taking the width into account) for the purpose of checking conformity to production process tolerances. No experimental data, sample calculations or test results are given in the purely theoretical treatment. References: 3 Russian.
[333-8225]

UDC 519.688:621.396.6.001.24

SET OF MULTIPLE TARGET FUNCTION OPTIMIZATION ALGORITHMS FOR LINEAR FUNCTIONAL UNITS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 6, Jun 81 (manuscript received 19 Jun 80, after revision 23 Oct 80) pp 85-90

KURILIN, B. I., PUGANOV, V. P., MICONYCHEV, I. A., KOTEL'NIKOVA, M. Yu., YAKORNOV, Ye. A., ASTISTOV, G. G., KONDRATENKO, S. S. and LYASHENKO, I. S.

[Abstract] The set of algorithms for multiple target function optimization of electronic equipment structures and parameters is the most important component of the software for automated design systems. Such a basic algorithm is proposed which is predicated on the approximate solution of incompatible equations through a generalized sequential linearization technique; this allows the localization of all the extrema of a multiple extremum problem. The algorithm flow chart is drawn, showing the steps and relevant subroutines. The functions of the algorithm include: Optimizing the parameters of a functional unit; optimizing the tolerances of such unit elements with unknown tolerances for the output characteristics and unit parameters; minimizing the parametric sensitivity of the unit to destabilizing factors; optimizing the tolerances of multichannel devices based on the criteria of identical output characteristics; optimizing the parameters of a mathematical model of a functional unit based on known experimental data; optimizing the requirements placed on a functional unit with incorrect technical specifications. An example of applying the algorithm to the minimization of the parametric sensitivity of the resonant impedance of a coaxial resonator, consisting in finding the point of insertion of the coupler which minimizes the change in this impedance in a specified frequency range, is cited. The algorithm uses the ALGAMS language (Minsk 32 digital computer, MIE-2 translator) as well as those indicated in the following table:

Table 1.

Type of Digital Computer	Number of Functions	Number of Parameters	Computing Time, min.	Program Language	Remarks
BESM-6	6 - 15	4 - 12	0.17 - 1.5	FORTRAN	Dubna monitor system.
	20 - 30	15 - 25	5 - 35		
YeS-1030	6 - 15	4 - 12	0.7 - 5.0	FORTRAN	DOS [Disk operating system]
	20 - 30	15 - 25	10 - 45		
M-220	6 - 15	4 - 12	2 - 25	ALGOL	TA-1M translator
	20 - 30	15 - 25	45 - 80		TA-2M translator

When optimizing a transistor model using Fletcher-Powell's method, no physically acceptable solution was obtained with 20 different randomly taken initial approximations; this algorithm found such an optimum solution providing noise characteristics considerably better in a low noise RF amplifier than specified in the data sheet for the transistor. Figures 3; tables 1; references: 12 Russian.
[333-8225]

UDC 65-52

THEORY OF CONTROL OF ACTIVE MOBILE OBJECTS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian
No 6, Jun 81 (manuscript received 21 Apr 80) pp 26-31

KALININ, V. N., Leningrad

[Abstract] The object of the present paper is to outline the basic principles of construction of a mathematical model of active mobile objects (AMO) as an object of control, and to present a brief summary of the corresponding problems in order to attract the attention of a wider circle of investigators to the problems in question. The general mathematical model of AMO is considered along with the following concepts: mathematical model of motion of AMO; mathematical model of apparatus of AMO; mathematical model of interaction; and mathematical model of resource. A general statement of the problem of optimum control of AMO is presented, and optimum control of AMO in the case of interaction of the first kind is discussed. It is concluded that the problem of optimum control of AMO from a theoretical respect amounts to a nonclassical variation of problems which can be investigated on the basis of the use of the contemporary theory of optimum processes of control. Figures 1; references: 1 Russian.
[370-A-6415]

UDC 621.3.078

ONE BASIS FOR DETERMINATION OF DYNAMIC CHARACTERISTICS OF INERTIAL SYSTEMS BY ORTHOGONAL EXPANSION METHOD

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian
No 6, Jun 81 (manuscript received 10 Apr 80) pp 39-41

SEVRYUKOV, A. G., Moscow Higher Technical School imeni N. E. Bauman

[Abstract] The author presents a simple algorithm for construction of orthogonal bases with supplementary properties, which it is advisable to use during [illegible] solution of the following problem. Let the known optimum impulse transient function $k(t, \tau)$ be the solution to one of the problems of statistical optimization, e.g., the Kolmogoroff-Weiner type without consideration of its feasibility

in the case of a specified nonstationary, unalterable part of a synthesizable system. Also specified is the order of inertia $P_H = N_H - M_H$ part of the synthesizable system, where N_H and M_H are, respectively, orders of the left and right parts of a differential equation which describes the unalterable point. The author thanks V. V. Solodovnikov for valuable comments which were taken into consideration during editing. The paper was recommended by the Department (Kafedra) of Systems of Automatic Control, Moscow Higher Technical School imeni N. E. Bauman. References: 4 Russian.
[370-A-6415]

UDC 621.372

CALCULATION OF SENSITIVITIES AND INFLUENCE COEFFICIENTS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 6, Jun 81 (manuscript received 9 Oct 80, after revision 19 Nov 80) pp 100-102

BEREZKO, L. A.

[Abstract] Since the number of terms in the polynomial expressions used to represent circuit functions in calculating the sensitivity and 'coefficients of influence' of circuit components increases as 2^x, where x is the number of literal terms in the expression, such techniques are extremely cumbersome for large values of x. This paper proposes that the sensitivity and influence coefficients be calculated by a subcircuit method in which the subcircuits are described relative to the poles of the circuit by d-trees, i.e. by the sums of the weights of the k parent trees of unistor graphs of the subcircuits corresponding to the determinant and determinate kinds cofactors of the conductivity matrix. Two types of d-trees are defined for two-pole networks; the process of joining the subcircuits when deriving the circuit functions can be accomplished so that the equivalent circuits of the two-pole network corresponding to the circuit components, with the parameters ascertained in literal form, are coupled to the last queue. The starting circuit is thus a set of an N-pole network not containing the parameters being ascertained, the d-tree of which is computed once, and the two-pole networks with the parameters being determined. General expressions are derived for any circuit functions which have the advantage of improving the speed and memory economy of the computer (by factors of 1.5 to 2 to 2.5 where x = 10 to 12, for circuits, the unistor graphs of which contain 20 to 25 nodes and 50 to 60 branches) when computing the sensitivity and coefficients of influence of elements with literal parameters. No sample calculations or experimental data are given. References 3: 2 Russian, 1 Western.
[333-8225]

UDC 621.372.2:681.3

ALGORITHMS AND PROGRAMS FOR DIGITAL CIRCUIT DESIGN USING BIPOLAR TRANSISTORS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 6, Jun 81 (manuscript received 9 Jun 80, after revision 8 Dec 80) pp 47-53

[Abstract] The functional analysis of various components in bipolar transistor digital circuits (TTL, DTL, I^{2}L, ECL, etc.) makes it possible to determine the functions needed to realize basic logic operations. The elements (PCFE's). The generalized representation of a digital circuit in the form of connected PCFE's is called a current graph, which has several possible circuit variants. The formal technqiue of synthesizing bipolar digital circuits consists in making the transition from a specific logic expression to the current graph realizing it and the subsequent substitution of the circuit variants for the PCFE's; this transition is made in three steps: 1) An original current graph containing combiners, branching devices and switches is drawn up based on the logic expression; 2) Current sources for the electrical operation of the circuitry are inserted in the current graph; and 3) The PCFE's are then replaced in the current graph by their possible circuit hardware. The requisite conditions for all of these steps are discussed and the concomittant algorithmic flow charts are drawn. The result is an LSI automated design system which generates and selects circuit variants in accordance with the needed logic functions and the basic parameters: power consumption speed and chip area. The programs are written in FORTRAN-IV for the Unified System of Computers and have an overall volume of about 850 operators. Some 82 Kbytes of mainframe memory are required as well as a peripheral magnetic disk for archive storage. The programs can construct current graphs containing up to 200 PCFE's, which corresponds to 100 to 200 of the simplest logic gates (AND, OR, NOT) and can design circuits containing up to 500 components. Figures 4; tables 2; references 13: 12 Russian, 1 Western.
[333-8225]

UDC 621.372.061

UTILIZING PROPERTY OF MACROMODEL STRUCTURE ORIENTATION IN CIRCUIT DESIGN WITH EQUIVALENT CIRCUITS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 6, Jun 81 (manuscript received 29 Dec 80) pp 98-100

BAKHOV, V. A.

[Abstract] When developing specialized algorithms for automated circuit design which are compatible with existing software, it is possible to employ specific features of electrical equivalent circuit macromodels to reduce the number of computer operations. A 'subcircuit' technique is proposed which is based on the decomposition of the circuit into N fragments (subcircuits). Reducing the differential equations for the circuit to algebraic form yields the

mathematical model: $f_o(x_o) = 0$ (1a); $f_i(x_i, x_{0i}) = 0$, $i = 1, \ldots, N$ (1b), where i is the number of the subcircuit, x_i is the vector of the subcircuit internal variables; x_o is the resultant vector of the boundary variables, while x_{0i} is its i-th subvector, corresponding to the i-th subcircuit. The following simplification is imposed: along the solution trajectory for (1a), equation (1b) should be satisfied. This means that after each iteration step for (1a), the values of x_{0i} are treated as parameters of equation (1b) from which the values of x_i are determined (for the method of nodal potentials, x_{0i} is the vector of external e.m.f. sources). This eliminates the need for coupling matrices for certain types of digital circuit macromodels: their border can be arbitrarily complex, though the nucleus of the model usually contains logic operators and E, R, C networks with asymmetrical capacitances and threshold controlled e.m.f.'s to generate the delays and edges of the output signals. It is shown that for a certain class of structures, the convergence of the iteration process for a coupling equation of type (1b) can be guaranteed and the algorithm can be designed so that in terms of the computer load, it is equivalent to one iteration or less. The iteration theorem is proved and the applications of the technique in the SPROS (circuit optimization and design program system) is described. The theoretical treatment adduces no experimental data or sample calculations. References: 4 Russian.
[333-8225]

UDC 621.382.82.001

SYSTEMS VECTOR RELAXATION TECHNIQUE FOR MULTIDIMENSIONAL NUMERICAL ANALYSIS OF SEMICONDUCTOR DEVICES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 6, Jun 81 (manuscript received 22 May 80, after revision 17 Nov 80)
pp 59-67

ABRAMOV, I. I. and MULYARCHIK, S. G.

[Abstract] The large amount of machine time required for multidimensional modeling of semiconductor devices has necessitated more efficient techniques than Newton's method; while Gummel's or Seidman and Choo's iterative schemes are memory efficient, they converge slowly in multidimensional modeling and are inefficient with large forward biases and small carrier lifetimes. The relaxation method of Ortega and Reinboldt for the solution of partial differential equations is generalized in the form of a systems vector relaxation scheme (SVR). It is shown that the techniques of Gummel and Seidman-Choo are special cases of the SVR method; a new method is developed from this general class and illustrated using the example of a two dimensional numerical analysis of a bipolar transistor. The reason for the possible divergence of the Seidman-Choo technique from the initial approximations actually used, which the authors term "poor", is found. This is accomplished on analogy with such concepts as "numerical diffusion" and "numerical dispersion" through the introduction of the concept of "numerical recombination" and "imbalanced charge" which characterize the quality of the

initial approximation in the numerical analysis of semiconductor devices. The described technique is the basis for the RELAX 2 program for bipolar transistors written in FORTRAN IV for a Unified System computer with an overall memory of 200 Kbytes. The proposed approach is compared with Seidman and Choo's for various external bias voltages and recombination levels. The latter method employed the COTDABSC program. The efficiency of the proposed new technique increases sharply with an increase in the recombination and this is illustrated graphically; it is faster than Seidman and Choo's, has an extended range of convergence and is applicable to any recombination levels of practical interest; the method requires the same memory capacity as other techniques of the SVR class. The running time for the numerical experiments ranged from 3 to 20 minutes on a YeS-1040 computer. Figures 4; references 23: 8 Russian, 15 Western.
[333-8225]

UDC 621.396.019.3

SOME POSSIBILITIES OF OPTIMIZING DEGREE OF CONTROL IN RADIO ELECTRONIC EQUIPMENT

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 8, Aug 81
(manuscript received 15 Jul 80) pp 56-60

MARTYNENKO, O. N. and SERDAKOV, A. S., Khar'kov

[Abstract] Ordinarily, contemporary radio electronic equipment can be separated into functional elements (FE) of various levels up to primary. Its restoration is accomplished by replacement of the FE of a specified level which has failed. If this level is selected, then it establishes an accepted degree of control. The latter is maximum at that time when failures are localized with a degree up to primary FE. Obviously, the maximum degree of control also assures the minimum expenditure connected with replacement of the failed FE. However, this does not indicate that the total expenses connected with restoration are minimized. In fact, with an increase of the degree of control, the cost as a rule of the necessary automatic system of control is increased and the rate of restoration decreases. Given the presence of these contradictory tendencies, it is possible to expect that some optimum degree of control exists which corresponds to the minimum cost for restoration of the object. One of the possible methods of solving such problems is considered in the present paper, and a method is described for determining the elements of an infinitesmal matrix and a gain matrix. The procedure proposed makes it possible to avoid the solution of systems of m + 1 linear controls at each iteration, which considerably reduces the calculation time and the volume of the computer memory which is occupied, while with the magnification of the dimensions of the problem these indices increase negligibly. Tables 1; references 3: 2 Russian, 1 Western.
[54-6415]

UDC 658.511.011.56.018

ORGANIZATION OF INDUSTRIAL INFORMATION-MANAGING SYSTEM PLANNING ON BASE OF MINI- AND MICROCOMPUTERS

Moscow STANDARTY I KACHESTVO in Russian No 8, Aug 81 pp 28-31

DENISOV, V. F.

[Abstract] One of the directions of work on an increase of the effectiveness of production and the quality of output is the use of industrial information-managing systems (IIMS) within the limits of the workshop automated control systems. The creation and efficient use of IIMS depends on the development of mathematical methods of supervision and control of industrial processes and the utilization of series output of a sufficiently wide list of technical means and basic program-software of a system of small computers. However, the appearance of new methods and means of control does not solve the ultimate problem of creating a highly effective IIMS. In order to increase the quality, effectiveness, and scientific-research level of IIMS with a considerable reduction of the time and cost of their planning, development is necessary of a series of organizational-technical measures. The most important factors which determine the effectiveness of development, and the directions for improvement of the organization of IIMS development are discussed. A large structurel diagram shows the setting up of the development of information-managing systems. Items in the diagram are based on typical stages of "scientific-research work" and "experimental design operations." A set of models for a systematic design of IIMS is proposed which makes use of typical design solutions for various mini- and microcomputers. This paper is based to a considerable extent on work by Denisov published in 1979 and 1980. Figures 2; references: 7 Russian.
[58-6415]

UDC 681.3:007.62

EFFECTIVE REALIZATION OF ADAPTIVE ALGORITHMS OF MULTICRITERION OPTIMIZATION PROBLEM FOR OPTOELECTRONICS COMPUTER

Moscow MIKROELEKTRONIKA in Russian Vol 10, No 4, Jul-Aug 81
(manuscript received 18 Jan 80) pp 292-301

EYDUK, Ya. Yu. and MIYEZERIS, Ya. A., Riga Polytechnical Institute

[Abstract] In principle, certain problems require the use of a dialogue between man and computer, e.g., the problem of multicriterion choice in which a search is made for a compromise solution on the base of additional information received from a person accepting the solution (PAS). During the solution of the problem of multicriterion optimization, for giving PAS a routine portion of the information, the computer must often accomplish unwieldy calculations, which leads to an intolerable delay of responses. One of the ways which leads to a decrease of

the response time is the organization of parallel processing. Realization of parallel calculation requires both the creation of computing systems (CS) of a particular structure and the corresponding software. During development of such systems it is necessary to solve three basic problems: assignment of the calculations, planning of assignments and control of the parallel calculating process. At present much attention is given to the first process, i.e., development of parallelism. Two methods exist for assignment of calculations: either in the form of a parallel program in which are the already indicated parallel branches, or in the form of a series of programs in which it is necessary to establish parallel segments. An approach to algorithms of multicriterion optimization is considered. The following concepts are explored: 1) The multicriterion formulation of problems of optimization generalizes the problem of scalar optimization in the case when the number of criteria $k > 1$; 2) The problem of multicriterion optimization consists in the desire to satisfy simultaneously several conflicting requirements which is impossible without compromises; 3) In some multicriterion problems specific criteria are strongly ordered with respect to importance so that it is necessary to obtain an increase of the more important criteria; 4) It is possible to unite a comparatively large group of adaptive algorithms of multicriterion optimization under the general designation "multipurpose programming;" 5) In multicriterion problems with absence of a priori information concerning interconnections between individual criteria, it is possible to obtain maximum information on the problem in question after singling out the set Pareto P; 6) Reduction of multicriterion problem to the problem of stochastic programming; and 7) Multicriterion adaptive methods with use of a vector-relaxation search algorithm. The structure of successive algorithms for the solution of the problem of multicriterion optimization is discussed. Block diagrams are presented of the following: 1) Typical sequence of elements of the structure of optimization algorithms; 2) Algorithm of random descent as applied to minimization of the function of the contraction W(X); the descent is accomplished by the method of dichotomies; and 3) Vector-relaxttion algorithm of random descent; descent is accomplished by a modification to the vector-relaxation process by the method of dichotomies. The structure is discussed of parallel algorithms of multicriterion optimization, and a comparative analysis is made of successive and parallel adaptive algorithms of multicriterion optimization. Block diagrams are presented of an algorithm of random descent with use of parallel calculations, and a vector-relaxation algorithm of random descent with use of parallel calculations. The prospects are considered for the use of optoelectronic computers for realization of the specified algorithms. Figures 7; references 14: 13 Russian, 1 Western in translation.
[338-6415]

UDC 681.3.02;681.327.21

SELECTION OF TELEMETRIC INFORMATION DURING INPUT TO COMPUTER

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian No 4, Jul-Aug 81
(manuscript received 24 Sep 79) pp 92-96

BELIK, VIKTOR KIRILLOVICH, candidate of technical sciences, senior scientific research worker, Institute of Cybernetics, UkSSR Academy of Sciences, Kiev

[Abstract] The author proposes a possible method for formalization of the problem of indexing and selection of telemetric data, based on an analysis of multichannel measuring systems with time separation of channels, and which amounts to use of the widely-known operation of multiplication of a matrix by a vector, as well as the operation of substitution, the order of fulfillment of which is determined by the graph of the system of commutators of the measuring system. Figures 3; references: 6 Russian.
[368-6415]

UDC 681.511.22:681.513.5

CONTROL, CPTIMUM WITH RESPECT TO RESOURCE EXPENDITURE, OF DYNAMIC OBJECT

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 6, Jun 81 (manuscript received 11 Mar 80) pp 31-36

LUCHKO, S. V. and KRYZHANOVSKIY, V. I., Leningrad

[Abstract] In the literature the problem of forming control, optimum with respect to source expenditure, is solved for the simplest objects not above the second order. The present work considers methods of forming such control for complex dynamic objects. A method is presented for reducing the problem in the original arrangement to a problem of linear programming, and limitations are obtained in the form of systems of linear equations, as well as a specific function. With the use of one of the methods of linear programming plus three relations derived in the text it is possible to find a sequence of control pulses, which assures transfer of the controlled object into a specified position with a minimum expenditure of resources. Figures 1; references: 4 Russian.
[370-A-6415]

CERTAIN ASPECTS OF PHOTOGRAPHY, MOTION PICTURES AND TELEVISION

UDC 534.843.072:51]:681.3

COMPUTER STUDY OF ACOUSTICAL PROPERTIES OF AUDITORIUM DESIGNS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 5, May 81 pp 31-33

BENTSIANOVA, Yu. Ye., All-Union Motion Picture Scientific-Research Institute

[Abstract] Computer simulation is applied to the problem of determining the acoustical pulse response of a three-dimensional auditorium model in the form of a simple rectangular solid. Complexity is reduced by treating a two-dimensional closed space with the following assumptions: 1) The edge effect with sound absorption, i.e. diffraction, is neglected; 2) The average surface absorption factor is taken as constant and independent of the incident angle of the sound waves; 3) Phase phenomena are not considered; and 4) It is assumed that the sound source is a point omnidirectional source transmitting an infinitely short pulse. The algorithmic structure of the computer model is outlined; the reflection areas for an arbitrary sound ray are plotted for the two-dimensional model along with the amplitude of various reflections as a function of time. Though no experimental data are given, it is proposed that the simulated pulse response of the room will serve to determine the numerical values of auditoria acoustic quality criteria. Figures 4; references 6: 1 Russian, 5 Western.
[335-8225]

UDC 621.317:621.397.13

ORGANIZATION OF MONITORS AND INSTRUMENTATION IN LARGE TV SYSTEM BASED ON EXAMPLE OF OLYMPICS TELEVISION AND RADIO COMPLEX

Moscow TEKHNIKA KINO TELEVIDENIYA in Russian No 5, May 81 pp 42-46

KRYLKOV, V. F., KURAKOV, Ye. L., PALITSKIY, V. M. and YASHCHENKO, K. A.

[Abstract] The olympics television and radio center (OTRK) is now incorporated in the Technical Television Center imeni the 50th Anniversary of the October Revolution, which is the base TV center for central broadcasting. Particularly stringent requirements were placed on channel conformity to specifications and

matching because the number of final output feeds for the olympic programs ran up to 20 while the input sources exceeded 500. This paper is an analysis of the functional configuration of the entire center and the technical specifications for the monitor and test equipment. Block diagrams illustrate the systems for monitor and test equipment. Block diagrams illustrate the systems for monitoring and instrumenting OTRK signal sources and output feeds, the functional configurations of the monitor equipment rooms and program source studio equipment. The tabular data on the technical specifications covers 15 different parameters for horizontal trace test signal channels, 5 video signal level parameters, 4 composite color TV signal parameters and 6 quality indicators for camera channels, citing the measurement units, measurement error and ranges involved. It is noted that through the building-up of the branched channels step by step while always providing for precise measurements of channel performance, it was possible to assure TV signal transmission with practically no perceptible distortions. Provisions made for greater adjustment flexibility have reduced the stringency of requirements placed on equipment design tolerances. Figures 3; references 13: 12 Russian, 1 Western.
[335-8225]

UDC 621.373.144.1:621.397.332.1].049.77

SECOND GENERATION INTEGRAL MICROCIRCUIT FOR LINE SCANNING GENERATORS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 8, Aug 81 pp 40-43

SKLYAR, V. A. and YAKOVLEV, S. B., Moscow Electrical Engineering Institute of Communications

[Abstract] At present, in line scanning generators, the K174AF1 microcircuit, series produced in the USSR, is widely used in the capacity of a synchronization circuit and for preliminary shaping of control voltages. In so doing, the output stages of the line scanning generators of color and black and white television receivers are achieved on the basis of discrete elements. The successes reached in semiconductor technology made it possible to develop integralcircuits (IC) of the second generation with an increased degree of integration which permitted expansion of the functional completeness of the microcircuit and an improvement of its parameters. The principal direction in the development of microcircuits for line scanning is the creation of unified microcircuits which can operate in various TV receivers. At the basis of the new K174XA11, functional and circuit engineering solutions were taken, obtained during the creation of the K174AF1. However, the functional possibilities of the new microcircuit expanded the introduction of new elements. These additions increase the stability and reliability of operation of the microcircuit with direct control by the output of the IC thyristor or transistor of the output stage of the line scanning generator without intermediate matching stages. The microcircuit contains more than 500 elements, of which 198 are active. They are fulfilled on a silicon crystal with dimensions of 2.1 x 3.9 mm which are placed in a plastic 16-lead out housing with a two-row arrangement of Type 238-16-3 lead outs. The functional

circuit of the IC is presented and explained. The following items are discussed: 1) Selection device; 2) Phase detector 1 and first loop of phase control; 3) Phase detector 2 and second loop of phase control; 4) Shape of strob pulse for selection of color subcarrier and suppression pulse; and 5) Output stage.
Figures 5; tables 1.
[373-6415]

UDC 621.385.832.564.4

VIDICON OPERATION WITH NANOSECOND EXPOSURES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 5, May 81 pp 49-50

VAYSBERG, V. A., LAPUK, A. G., MAGID, R. M., MIKHAYLOV-TEPLOV, N. N., NIZHEGORODOV, S. P. and PERLOV, D. I.

[Abstract] A LTIPCh-6 laser at 532 nm with a pulse width of 15 nanoseconds was used to determine the response of three vidicons: LI421 with a homogeneous Sb_2S_3 target; LI457 with a PbO target having a p-i-n photodiode structure; LI439 with a heterostructured target based on CdSe. The absolute spectral sensitivities of these vidicons are plotted as a function of wavelength and summarized in tabular form for both pulsed and continuous exposures. The input energy to signal conversion efficiency of the LI439 and LI457 vidicons depends on the energy level: an energy of about $90 \cdot 10^{-10}$ J/cm^2 is required by the LI439 to generate a 100 na signal while about $40 \cdot 10^{-10}$ J/cm^2 is required for the LI457 in the same case. The LI421 and LI457 exhibited greater photoelectric efficiency with nanosecond light pulses than under standard operating conditions, while the opposite was the case for the LI439. No anomalies were found in the signal storage and decay characteristics for any of the devices studied. Figures 2; references: 2 Russian.
[335-8225]

UDC 621.397.6.049.77

GENERAL PURPOSE MICROCIRCUIT OF HIGH-SPEED CLOCK PULSE SHAPER FOR CHARGE COUPLED DEVICES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 8, Aug 81 pp 37-39

GOL'DSHER, B. I., DIK, P. A., LASHKOV, A. I., ROGATKIN, Yu. B. and STENIN, V. Ya.

[Abstract] At present the problem of microminiaturization of a clock pulse shaper (CPS) is still not completely solved. Known circuits pertain either to hybrid microcircuits or to monolithic, as related to slow microcircuits based or MIS devices, which with respect to a combination of its electrical and design parameters do not satisfy the requirements imposed on the performance of a

general purpose CPS. The absence of a monolithic integrated circuit of a CPS for control of units based on charge coupled devices (CCD) limits to a considerable degree the use of the latter, e.g., in portable television cameras. The present paper considers the principal electrical requirements on a monolithic microcircuit for a CPS and describes the development of a four-part CPS, the principal circuit of which is presented. A photograph is shown of a microcircuit and its topology. The microcitcuit is placed on a 2.2 x 2.2 mm^2 crystal. It contains approximately 150 elements, including 8 power transistors which occupy approximately 15% of the useful area of the crystal. This microcircuit makes it possible to control two-phase, three-phase and four-phased CCD. The microcircuit developed is in fact a power amplifier, and can find use not only for control of CCD, but also in class "D" amplifiers, voltage regulators and other radioelectronics equipment. Figures 6; references 3: 2 Russian, 1 Western (in translation).
[373-6415]

UDC 621.397.13:778.38

TELEVISION TECHNIQUES OF MOVING IMAGE ANALYSIS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 5, May 81 pp 51-55

SMIRNOV, V. V. and YASKEVICH, G. F.

[Abstract] While the analysis and equalization of TV images obtained in coherent and incoherent light have been studied in considerable depth, there are practical cases of partially coherent illumination where the elements of coherency are introduced into the image produced on the photocathode of the TV tube by the optics of the TV camera. The specific features of images in partially coherent light allow for the automatic analysis of image quality and various kinds of special effects. This paper briefly treats the problem of TV analysis of moving images using TV pulsed holography and spatial filtering of the optical images. The sensors of TV analyzers of moving objects can operate with the light either transmitted through them (the 'light field' mode) or in reflected light ('dark field'). The TV image is produced at the moment of vertical retrace. In the light field mode, the light pulses illuminate the photosensitive layer of the tube. TV sensors using the LI218 and LI225 superopticons provide a "signal/noise" ratio of about 10 with illumination using 10^{-6} sec pulses in the light field case. The principles of application of such methods to moving image analysis and such as related circuitry as noise suppressors designed around ultrasonic delay lines are treated in some detail. The change in the width of video pulses corresponding to the diameter of the images of plexiglass spheres 70, 46 and 28 micrometers in diameter and the width of the first diffraction ring are shown graphically for a superopticon sensor as a function of the displacement of the spheres from the sighting plane. Photographs of a 20 micrometer sphere before and after spatial filtering when the sphere was shifted 1.5 mm demonstrate the possibility of reliable recording of only the first diffraction ring. The experiments show that pulsed holography with partially coherent

illumination makes it possible to circumvent such limitations inherent in traditional TV moving image analysis as the ambiguity in the depth of field in a wide range of object sizes, imprecise measurements, etc., as well as the difficulties in holographic techniques related to real time measurements, the increased requirements placed on vibrational stability, etc. A transition to a dark field mode using spatial filtering should make it possible to botain more complete information on moving objects (degree of defocusing, size, concentration, shape and speed). Figures 5; references: 14 Russian.
[335-8225]

UDC 621.397.61:681.772.7

CONTEMPORARY TRENDS IN DEVELOPMENT OF TELEVISION--MOTION PICTURE EQUIPMENT

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 8, Aug 81 pp 34-36

LUNEVA, Z. P. and NOVAKOVSKIY, S. V., Moscow Electrical Engineering Institute of Communications

[Abstract] Cathode-ray tubes with charge storage, scanning beam systems and devices with charge coupling are used in contemporary equipment for television transmission of motion picture films. The present paper discusses the advantages and disadvantages of each of these methods and lists a number of equipment parameters. A block diagram is shown and explained of a device for conversion of video signals in a television--motion picture transducer with digital processing of the signal. Information exists that in the near future digital methods will be used abroad for processing signals, in order to obtain high uniformity of sensitivity, gamma correction, aperture correction and color correction. Figures 1; references 13: 4 Russian, 9 Western.
[373-6415]

UDC 621.397.62

METHODS OF ELECTRONIC SIMULATION OF GAME SITUATIONS IN TELEVISION SIMULATORS AND GAME AUTOMATA

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian No 4, Jul-Aug 81
(manuscript received 23 Jun 80) pp 52-55 + inside back cover

BARANOV, ALEKSANDR IVANOVICH, chief engineer, Public Design and Technological Bureau (OKTB), Institute of Metal Physics, UkSSR Academy of Sciences, Kiev, VASIL'YEV, VSEVOLOD VIKTOROVICH, doctor of technical sciences, head of department, Institute of Problems of Modelling in Power Engineering, UkSSR Academy of Sciences, Kiev, and DANILYAK, SERGEY NIKOLAYEVICH, junior research worker, Institute of Problems of Modelling, UkSSR Academy of Sciences [Note: In a number of places in the text, VASIL'YEV is listed as the principal author and BARANOV is placed in either the second or third place.]

[Abstract] A number of methods or electronic simulation of game situations in television simulators and game automatia are fairly briefly considered and analyzed. A concrete solution is presented for the problem of electronic simulation of television images with the aid of the methods of mathematical logic and a game simulation complex based on nine game situations is created. A block diagram of the television simulator is shown in three colors which represent the quantization blocks, the forming and control blocks and the auxiliary blocks. A detailed explanation of each of the blocks is presented. Figures 1; references: 7 Russian.
[368-6415]

UDC 681.7.068.621.397.61

FIBER OPTICS LINE FOR PORTABLE COLOR TV CAMERAS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 5, May 81 pp 46-49

ALISHEV, Ya. V., KIRILLOV, V. I., KIRIL'CHUK, V. B., LIPKOVICH, E. B., MAR'YANKOV, A. A. and TKACHENKO, A. P., Minsk Radio Engineering Institute

[Abstract] A fiber optics communications line can replace the conventional coaxial cables used for portable color TV cameras. The design of a fiber optics system for the transmission of three video signals is detailed (V_R, V_B, V_G or V_R, V_W, V_B) for applications to mobile studios and minicameras. The system incorporates three identical video channels, which consist of an input amplifier driving an electrooptical converter, a device for matching to the fiber optics, the optical fiber, an output fiber to converter matcher, optronic converter and an output amplifier. A schematic of the fiber optics system transmitter shows a transistorized amplifier and modulator driven by an AL-106B or AL-106V LED. A similar schematic for the receive circuitry shows a FDK227 light sensitive diode used as the detector driving the preamp and processor circuitry. The

fiber optics cable has three cores of two-layer fiber with an internal diameter of 400 micrometers. Among other specifications, the test figures are: an amplitude-frequency response between 1 and 6 MHz flat within 1.1 dB and a relative peak-to-peak value of the overshoot at the peak of a square wave pulse of 4% with a signal to unweighted noise ratio as good as 54 dB. It is noted that the fiber optics system designed here is not the only one possible: when optical cable cores less than 100 micrometers in diameter are used LED's are unsuitable, which necessitates the use of semiconductor lasers, though the latter are efficient only in a pulsed mode. This would in turn require high quality pulsed TV modems meeting broadcast requirements and compatible with portable camera units. Figures 3; references: 7 Russian.
[335-8225]

UDC 778.38:778.5:771.537

HOLOGRAPHIC PROJECTION OF STATIC THREE DIMENSIONAL IMAGES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 5, May 81 pp 38-41

NALIMOV, I. P., All-Union Motion Picture Scientific-Research Institute

[Abstract] A general discussion of the classification of holographic three-dimensional image projectors is followed by a detailed analysis of the principles underlying a holographic projector using a translucent focusing screen. The following parameters are specified in the design of holographic projectors for static images: the diagonal size of the screen and the hologram; the projection magnification; the distance to the screen or the viewing angle of the screen image; the screen image depth; the overall height width of the viewing region; and the diameter of the viewing subregions as well as the number of viewing locations and their position angle. This set of initial parameters which can be specified in the form of numbers express the parameters of the optics and projector design. Coefficients of deformation with respect to depth and flutter of the screen image are introduced making it possible to characterize the major parameters of a three-dimensional image. The design formulas which are derived are applied to the design of five different holographic projectors, of which four have been built and tested. Projectors with screen diagonals of 780 and 500 mm have been fabricated, while projectors with diagonals of 225 and 150 mm are planned. Though this series of projectors basically meets the needs of no more than 15 viewers, the possible projection configurations are not exhausted. Figures 4; references: 8 Russian.
[335-8225]

UDC 621.372

OPTIMIZING ELECTRONIC CIRCUIT PARAMETERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 6, Jun 81 (manuscript received 10 Jul 80, after revision 6 Jan 81)
pp 73-79

NAGORNYY, L. Ya. and SHIBITSKIY, V. P.

[Abstract] The problem of optimizing the parameters of electronic circuits can be solved by using the concept of circuit branches without setting up intermediate models. A one-to-one correspondence is established for the subsets of the initial circuit branches and coefficients of the polynomials of the specified function of the complex variable being optimized. In this system of set relationships, the unknowns are the branches of the subnetworks. The original circuit network is treated as a binary relation for the sets of pairs of angles and types of branches. The direction of a branch is mapped with the order of the nodes in a given pair and fixed only for active and dependent branches. The network branches can be enumerated according to the pairs of nodes; however, an additional set and function is introduced into the algorithms to discriminate parallel branches and define indicators. This approach to circuit optimization based on these set analogs of the concepts inherent in the circuit itself results in an algorithm which is applied to sample circuits of various complexity, which realizes the following transfer function F(p) of the complex variable p: $F(p) = b_0/a_3p^3 + a_2p^2 + a_1p + a_0$; the routine was run on an M-4030 computer using the DOS 2.1 disk operating system. The most complex circuit analyzed in the test case has 6 nodes, 9 branches and 55 trees. The set of resonant frequencies and the distribution of the trees with respect to the frequencies are given. The computer time for the minimization of the functional was 4,679 seconds. The basic advantage of the algorithm is the elimination of intermediate models and reduced memory requirements. Figures 4; references: 8 Russian. [333-8225]

UDC 621.372.001.24:681.3

STRUCTURAL CIRCUIT DESIGN FOR ELECTRONIC CIRCUITS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 6, Jun 81 (manuscript received 19 Jan 81) pp 80-84

GLORIOZOV, Ye. L. and PANFEROV, V. P.

[Abstract] The major step in any circuit design is the structural synthesis in which the basic circuit structure is determined. The problem of synthesizing nonlinear transistor logic gates starts with the transistors, the point of insertion of which, the orientation relative to the circuit nodes and the transistor type are determined during the search procedures. This paper employs the concepts of set theory and tensor calculus to formally state and apply these procedures for such nonlinear circuits as computer switches. A graph (Boolean tensor) with specified coordinates defines the configuration of the transistor relative to the passive components and all of the operators needed to realize the structural synthesis are defined. A rigorous mathematical formulation is given for the conversion of a single transistor common emitter circuit to a single transistor common collector, and then to a two transistor configuration. The basic structural design process can be summed up in two steps: The first synthesis step from the initial state by means of the tensor operator which describes the generation of a new circuit by changing the existing components and secondly, the conversion of the circuit obtained in the initial step by the introduction of new components in accordance with the rules derived here. The theoretical treatment gives no sample calculations. Figures 1; references: 2 Russian.
[333-8225]

UDC 681.3:621.372.001.5

MODELING ELECTRONIC CIRCUITS IN GENERALIZED NODAL COORDINATE BASE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 6, Jun 81 (manuscript received 26 May 80) pp 37-46

SIGORSKIY, V. P.

[Abstract] The formulation of a mathematical model of an electronic circuit in the form of differential or algebraic equations is based on the conversion of the set of equations for individual components which describe ideal components, and the topological equations which relate the configuration of the components in the circuit. So long as the model deals only with regular dependent voltage or current sources or multipole networks, the circuit modeling problem is readily solved by classical techniques of nodal voltages and contour currents with the use of homogeneous coordinate bases. Where a circuit consists only of regular components (passive two-pole networks, independent current sources, dependent

voltage controlled current sources and any multipole components represented by systems of equations for voltage controlled currents), its state is described by a system of nodal equations written in terms of an admittance matrix and a master vector, determined from simple rules. To take irregular components into account (independent voltage sources and any other components, the equations of which are written in irregular form), irregular component currents are added to the set of nodal voltages and the system of nodal equations is correspondingly expanded. This paper proposes an approach to the incorporation of irregular sources in a model by means of the appropriate conversion of the admittance matrix. The analysis describes four basic sources (voltage and current controlled voltage and current sources), their curcuit models and the relevant transformation of the admittance matrix for the nodal coordinate base, which allows the representation of a linear circuit. The model in the nodal base can serve as the basis for setting the variable state equations and the linearized algebraic equations for a circuit. The result is a circuit model in a generalized coordinate base of minimum dimensions with maximum simplicity. Figures 2; references: 11 Russian.
[333-8225]

UDC 681.3:621.372.061

AUTOMATED STUDY OF KIND OF ELECTRONIC CIRCUIT QUALITY FUNCTIONS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 6, Jun 81 (manuscript received 17 Jun 80) pp 67-72

IL'IN, V. N. and KAMNEVA, N. Yu.

[Abstract] When parametrically optimizing electronic circuits, it is desirable to break the process down into two steps: 1) Study of the kind of optimized quality function and its identification for a more efficient choice of the optimization technique as well as the gathering of the raw data to set up the search process (the initial operating point, initial step, etc.); and 2) The extremum search process, based on the most efficient method for the determined class of functions, working from the initial conditions obtained in step 1. Because it is not always possible to use a display to determine visually the relief of the quality function being optimized, it is expedient in the case of a large number of input variables to analyze automatically the cross-sections of the function being optimized for the purpose of automating the process, or at least arriving at the most suitable optimization technique. The system proposed in this paper for the study of quality function cross-sections and the formulation of criteria for automatic selection of the optimization scheme plus the transition from the first to the second step uses the SPROS (circuit design and optimization program) system previously developed in order to determine automatically the form of the quality function cross-sections by means of rank correlation. The result of each modeling of a set circuit input parameters is treated as a random vector while each value of the optimized function corresponding to this vector, obtained through the modeling routines and circuit analysis, is treated as a random

quantity. The random quantity can be either an individual output parameter of the circuit (e.g. power consumption or speed) or a generalized optimality criterion which takes into account the set of output parameters and yields a compromise solution. The proposed program permits the study of the kind of function both with respect to one cross-section for each variable as well as several cross-sections. The iterative method is applied to a sample case of a circuit with five bipolar transistors, illustrating the reduction in the optimization time. Figures 4; references: 3 Russian.
[333-8225]

COMMUNICATIONS, COMMUNICATION EQUIPMENT, RECEIVERS AND TRANSMITTERS, NETWORKS, RADIO PHYSICS, DATA TRANSMISSION AND PROCESSING, INFORMATION THEORY

INCREASED EFFECTIVENESS OF MECHANICAL CABLE LAYING

Moscow VESTNIK SVYAZI in Russian No 7, Jul 81 pp 24-25

RYBAKOV, A. P., laboratory chief of "Mezhgorsvyaz'stroy" [MGSS] Trust (All-Union State Trust for the Construction of Long-Distance Wire Communications Structures)

[Abstract] The basic and most time-consuming process in the construction of long-distance cable lines is the laying of cable, which must be buried in the ground to a depth of 900-1200 mm. At present, in the MGSS Trust more than 80% of all the volume of work on laying cable is fulfilled by the nonditch method with towed cable-laying equipment of Type KU-120 (light), KUK-4 (heavy wheels), KUM-6M (marsh) and others, having cable-laying equipment with cutters. Their advantage consists in the fact that they are multipurpose for various soil-climatic conditions. With the aid of this cable-laying equipment, the MGSS has laid tens of thousands of kilometers of cable. However, present-day mechanized columns created on the base of towed cable-laying equipment have a number of shortcomings. Their elimination would help considerably to increase the effectiveness of work during laying of cable. One of the shortcomings is the requirement for significant tractive forces in order to overcome the resistance of the ground to breaking up. Consequently, present-day cable-laying mechanised columns use 6--7 Type T-100M(B) tractors. Use of such a number of tractors. requires special coupling devices and a large number of personnel, as well as large losses of operating time in coupling and maneuvering of tractors. The necessity which appeared in recent years to increase the depth of laying cable to 1800 mm, as well as the need to work at any time of year and on grounds of various firmness has led to the requirement for a further increase of tractive forces. Experiments conducted by the Trust indicate, for example, that at depths of 1500 and 1800 mm, 12 and 15 T-100M(B) tractors, respectively, would have to be used. Various methods of reducing these tractive forces are discussed and some items developed for this purpose are described. The special conditions to be overcome in developing cable-laying equipment for the north and far east sections of the USSR are considered. It is concluded that for solutions of the cable-laying problem, it is necessary in the Glavsvyaz'stroy (Main Administration for the Construction of Communications Installations) to create a highly-equipped base because the OMZ (expansion unknown) of the MGSS Trust, which at present is occupied with preparation of cable-laying techniques, is badly equipped and low-powered, or to attract plants of other interested ministries.
[372-6415]

TRANSIT OF REMOTE SIGNAL CHANNELS

Moscow VESTNIK SVYAZI in Russian No 6, Jun 81 pp 29-30

BURAKOVA, N. Ye., junior scientific worker, TsNIIS (Central Scientific-Research Institute of Communications), and RAPOPORT, E. Z., chief of laboratory

[Abstract] In local telephone networks, for organization of direct circuits between distant stations, permanent (nonswitching) transits of the audio frequency transmission channels are sometimes used, for which audio circuits are connected through an attenuator with an attenuation of 17 dB and a resistance of 600 ohm. It is difficult to organize transit of remote signal channels (RSC) which exist in the transmission systems KRRM, KAMA, IKM-12, IKM-30 and KNK-12, VKM-120, VKM-300 and others. This is caused by the fact that there are electronic devices at the input and output of RSC, not calculated for joint operation in a transit regime. Consequently, it is necessary to install additional adapters, different for various combinations of transmission. Methods for handling this problem are considered. Experimental checking of distortions of pulses during transit of RSC KAMA-KAMA and KAMA-UKM was conducted in 1978. The operative systems KAMA and the VKM-120 bay were used, connected through the circuit "to itself": KAMA--through an attenuator; the VKM-120 through a measuring amplifier. Synchronization of the generator devices of KAMA systems was produced from the overall synchronization network. The results of measurements of the transit of KAMA-KAMA are presented in Table 1, and KAMA-VKM in Table 2. These tables indicate that transit of RSC with the assistance of supplementary adapters leads to additional distortion of the pulses of a set, which with a junction of two channels amounts to ± 5 MHz. Figures 5; tables 2.
[364-A-6415]

INDUSTRIAL METHODS OF CONSTRUCTING RADIO RELAY LINES

Moscow VESTNIK SVYAZI in Russian No 7, Jul 81 pp 29-30

EYLENTUKH, A. M., chief technologist, GSPI-2 (State All-Union Planning Institute No 2), and ARTYKOV, A. A., chief of Technical Division

[Abstract] The USSR Ministry of Communications has placed before the scientific-research, planning and construction organizations of the ministry the problem of the maximum decrease of the volume of construction and installation work fulfilled directly at areas of radio relay stations (RRS), and a reduction of labor expended on RRS construction. In order to fulfill these problems it is necessary widely to introduce industrial methods of construction, i.e., to increase to the maximum extent the preparedness of a plant to take care of the elements and structural members being delivered to the site, and to accomplish all work at a high organizational-technical level and by advanced methods. A number of examples of industrial methods used in constructing RRL are presented. As an instance, much work is done by planning institutes of the USSR Ministry of Communications: GSPI (probably = State All-Union Planning Institute) and GSPI-2, together with construction organizations, in particular work with the "Radiostroy" (Radio Construction) Trust. The erection of technical structues

is the most time-consuming item during construction of RRS, because high requirements are imposed of them with respect to assuring an optimum temperature regime for the equipment. At present, for such structures, especially intermediate stations, containers are used--finished facilities with equipment installed in them. Containers worked on at various facilities are described. In the last ten years, for example, GSPI-2 together with the "Radiostroy" Trust developed DES containers with two assemblies of equipment. The USSR Central Design Office together with the Taldom Plant "Promsvyaz'" carried out development of the "Uran" type container which includes a specific type of radio relay equipment with a strictly stipulated full complement.
[372-6415]

UDC 621.371:621.373.374

MEASUREMENT OF PARAMETERS OF INDIVIDUAL AND PERIODIC RADIO PULSES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 9, Sep 81 pp 46-48

BALAMATOV, N. N. and ZALIVAKO, V. Yu.

[Abstract] The paper describes a method for measuring the phase difference between a high-frequency filled radio pulse signal and a reference signal in which the phase and amplitude are stable in time. The measurements are made for one period of high-frequency filling which is separated out by a strobe-pulse. The error of measuring phase amounts to ± 1'. The results of measurement of amplitude and phase can be turned over to a computer for processing or recorded on punched tape or magnetic tape. Measurement of the phase difference at the output of a radio receiving device is characterized by pronounced fluctuations of the amplitude of the radio pulse. In order to reduce the amplitude-phase errors, a thorough amplitude limitation with reinforcement is utilized. A block diagram is shown of a two-channel circuit for measuring the parameters of radio pulse signals and the methods of its operation are described. The proposed device was used during investigations of the spatial properties of a vector field of a radio wave, reflected from the ionosphere. Information concerning the parameters measured was recorded on a computer. Figures 1; references: 8 Russian.
[18-6415]

UDC 621.394.74

CONSIDERATION OF PROPAGATION TIME OF PACKETS WITH RANDOM MULTIPLE ACCESS

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 17, No 2, Apr-Jun 81
(manuscript received 20 Oct 80) pp 75-78

TSYBAKOV, B. S., MIKHAYLOV, V. A. and FEDORTSEV, S. P.

[Abstract] A 1978 work by Tsybakov and Mikhaylov presents a method of random multiple access of packets in a wide broadcasting channel with feedback and zero time propagation. This method is called "Stack-Algorithm-1." A Stack-Algorithm-1 with the condition of finite delay of the packets permits transmission of Poisson traffic with a velocity of 0.375. The present paper considers the use of "Stack-Algorithm-1" in a channel with an arbitrary preset propagation time r. The principal problem consists in the development of methods for the introduction of new packets into the channel. Two methods are proposed: separate and combined. The greatest speed of transmission of the Stack-Algorithm-1 is found to be a function of the propagation time. Figures 4; references: 5 Russian.
[369-6415]

COMPONENTS AND CIRCUIT ELEMENTS, WAVEGUIDES, CAVITY RESONATORS AND FILTERS

UDC 621.372.8

THEORY OF PRISM STORAGE WITH ANISOTROPIC INHOMOGENEOUS OPTICAL WAVEGUIDE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 5, May 81 (manuscript received 19 May 80) pp 636-642

MALOV, V. V., TUROVTSEV, A. V., and IOGANSEN, L. V., All-Union Correspondence Institute of Textile and Light Industry

[Abstract] The principal characteristics are calculated for a prism storage, all the layers of which are uniaxial dielectric crystals. The characteristic coupling length, misalignment, the resonance amplitudes of the field and other characteristics of the storage with a homogeneous anisotropic waveguide are found first, and then the case is considered of slightly nonhomogeneous anisotropic waveguides. A 1978 paper by Iogansen and Malov mentions one of the possible uses in integrated optics of anisotropic dielectric waveguides for control of laser radiation: scanning, focusing and others. It is noted there that prism storage with an inhomogeneous resonator waveguide of a uniaxial crystal, with the optical axis lying in the plane of propagation XZ and slowly turning with a shift along the waveguide, can be used for focusing radiation. In the present paper the theory for a similar storage is developed. The inhomogeneities in the waveguide and the inhomogeneity concentrated in the substrate are also considered. The physical pattern in these two cases are quite similar and can be understood if it is taken into consideration that the adiabatic change of direction of the optical axis of one of the media leads to an adiabatic change of direction of the wave vector k to a zigzag-shaped wave. As a result the possibility appears of focusing the radiated light, or, considering storage, pumping of cylindrical waves. As a different use of the theory, also considered is the timely question of 100-percent pumping into the waveguide of plane waves means the absence of reflected waves. The principles are found for rotating the optical axis, which assures: 1) Focusing of the radiation; and 2) Complete pumping of light into the waveguide. A calculation is made, the principal results of which involves the establishment of high sensitivity of the storage to inhomogeneities. The small inhomogeneity of the optical axis manifested as an angle of rotation of 10^{-2}—10^{-3} based on the typical length of the storage substantially affects the process of storage (radiation) of the waves. This is caused by the resonance nature of the storage which requires phasing of the waves at all the coupler length. The high sensitivity makes it possible to use various

exterior effects for control of radiation capable of giving rise to even the weak rotation of the optical axis. Figures 1; references 4: 3 Russian, 1 Western (in translation).
[375-6415]

UDC 621.372.822

FIELD COMPONENTS, ENERGY DISTRIBUTION AND ATTENUATION OF BASIC WAVE TYPES $E_{\parallel}^{x}$ AND $E_{\parallel}^{y}$ IN RECTANGULAR DIELECTRIC WAVEGUIDE WITH DIELECTRIC SUBSTRATE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 5, May 81 (manuscript received 8 Feb 80) pp 629-635

MURMUZHEV, V. A., Institute of Radio Engineering and Electronics, USSR Academy of Sciences

[Abstract] A rectangular dielectric waveguide (RDW) mounted in a substrate with a smaller magnitude of the dielectric constant can find wide use both in integrated circuits and in wide-band measurement elements for the millimeter band. In the case where the RDW is surrounded by media with various magnitudes of the dielectric constant, the effects are important of a shift of the maxima of distribution of the fields of $E_{\parallel}^{x}$ and $E_{\parallel}^{y}$ waves to the side of the medium with a large magnitude of the dielectric constant. This leads to a nonsymmetric redistribution of the energy of both wave types with respect to the cross section of the RDW, which causes a stronger effect of the dielectric substrate on the total magnitude of the attenuation of the $E_{\parallel}^{x}$ and $E_{\parallel}^{y}$ waves as a consequence of the dielectric losses. In the present work, the results are presented of a theoretical analysis of the energy distribution and losses in a RDW for the millimeter range with a small drop of the dielectric constant of the RDW and substrate. The components of the field, the distribution of energy and the attenuation of waves are analyzed. A table gives the results of a calculation of the structural attenuation factor for a RDW of polyethylene. The results of the theoretical analysis and the experimental investigations show that in the RDW based on a dielectric substrate the unsymmetrical distribution of the components of the electrical and magnetic fields of $E_{\parallel}^{x}$ and $E_{\parallel}^{y}$ waves with respect to the cross section in a significant way affects the distribution of energy with respect to the media and to attenuation of $E_{\parallel}^{x}$ and $E_{\parallel}^{y}$ waves. The author thanks V. V. Meriakri for furnishing data on the dielectric properties of fluorolons, and A. M. Markevich for assistance in the production of RDW substrates of fluorolons. Figures 6; tables 1; references 13: 7 Russian, 6 Western.
[375-6415]

UDC 621.373.826:772.99

BINARY CODING OF SPACE-FREQUENCY FILTERS FOR COHERENT OPTICAL PROCESSOR

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian
No 6, Jun 81 (manuscript received 14 Jan 80) pp 49-53

OCHIN, Ye. F., Leningrad Institute of Precision Mechanics and Optics

[Abstract] A complex transfer function of a space-frequency filter of a coherent optical processor is introduced and, as the result of a number of mathematical devices, it is shown that the problem of binary encoding of a complex transfer function filter reduces to the choice of a phase modulator and to the synthesis of binary masks, which minimizes the combined error of encoding. Generalized methods of binary endoding with tacit use of a prism are considered. A similar interpretation of the problem of binary coding of complex transfer functions can be generalized for the case of the multilevel encoding of W. H. Lee--C. B. Burchard. The paper was recommended by the Department (Kafedra) of Computing Techniques, Leningrad Institute of Precision Mechanics and Optics. Figures 2; tables 3; references: 10 Russian.
[370-A-6415]

CONVERTERS, INVERTERS, TRANSDUCERS

UDC 531.781.2.087.92:621.315.002

FEATURES OF TECHNOLOGY FOR PRODUCING INTEGRATED STRAIN TRANSDUCERS (SURVEY)

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 81 pp 30-32

VAGANOV, V. I., candidate of technical sciences, and GONCHAROVA, N. I., engineer

[Abstract] On the basis of material in the literature, the authors consider specific problems which appear during the development of mechanoelectrical transducers. Existing methods for their solution are given. It is understood that concrete sequences of technological operations for production of transducers with various structures differ from one another. However, between them there are many general characteristics which make it possible to present them in the form of a generalized technological sequence for the manufacture of integrated strain transducers (IST). The sequence is shown in a block diagram. The following divisions of the generalized stages are considered: 1) Preparation of initial product; 2) Oxidation of plates; 3) Two-way matching; 4) Production of integrated strain circuits; 5) Microshaping of plates; 6) Group connection of components in microconstruction; and 7) Distribution of plates on crystal. An example is presented of a concrete sequence of technological operations for production of integrated transducers with diffused resistance strain gauges on plates oriented in the (001) plane, with the use in microshaping of anisotropic etching of silicon. As a result crystals are obtained of shaped sensitive modules, one of which is shown. Figures 4; references 28: 14 Russian, 14 Western (3 in translation).
[374-6415]

UDC 621.313.320

ROTARY FREQUENCY CONVERTER WITH ADJUSTABLE AUTOTRANSFORMER

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 4, Jul-Aug 81
(manuscript received 28 Mar 80) pp 45-49

KRASNOSHAPKA, M. M. and KRASNOSHAPKA, D. M.

[Abstract] One of the pressing problems in many sectors of USSR industry, agriculture, transport and special regions of technology is the wide introduction of the most simple, safe and economical converters of alternating current of 50 Hz industrial frequency into alternating current with a stepped up frequency of 100-400 Hz and above. The increased frequency of the alternating current makes it possible substantially to reduce the mass and cost of electrical motors, transformers, magnetic amplifiers, and automation devices, as well as to increase the performance of electric drives and mechanisms. The present paper considers the principles of operation of a one-machine electromechanical converter of alternating current of industrial frequency into alternating current of increased frequency, the basic circuit of which is presented. The principal difference of the circuit of this frequency converter from others consists in the fact that matching and stabilization of the output voltage of the inverted rotary converter is accomplished by an autotransformer of special construction, which is connected to the side of the increased frequency of the converter. An example is presented of the concrete fulfillment of an inverted rotary converter on the basis of a PN-45 direct current generator with a power of 5.4 kV. Figures 2; references: 3 Russian.
[53-6415]

UDC 621.314

CALCULATING OPTIMALLY EFFICIENT NUMBER OF INDIVIDUAL UNITS COMPRISING ADAPTIVE VOLTAGE CONVERTERS

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 3, May-Jun 81
(manuscript received 25 Feb 80) pp 15-20

ISACHENKO, V. I., GRITS, Yu. A. and BASIN, Yu. G., Sukhumi Physics and Engineering Institute

[Abstract] Although the efficiency of a voltage converter (inverter) driving a variable load can be improved through an optimal choice of the output transformer rating, load changes by factors of several tens of times necessitate a converter configuration comprised of several individual units, driving the common load. Each unit can operate in a close to optimal mode and provide for nearly constant efficiency throughout the range of load variation. The design of such adaptive voltage converters (AVC's), consisting of a large number of identical power converters, is optimized with the following assumptions: the

losses in the control circuits for the individual units are disregarded; the power transistors of the units are controlled by positive load current feedback, making the excitation losses proportional to the load. The optimization criterion is then only the quality factor (or efficiency) of the output transformers of the individual units, while their overall volume or weight is constant. For AVC optimization with respect to average efficiency over the load cycle, the number of converter units does not exceed three in cases of practical interest. The optimum values of the design capacity of the transformers of the individual units form a geometric progression, while the optimal transformer volumes increase in step with the design capacity. The number of individual units is almost twice as great with AVC optimization for the greatest guaranteed efficiency in a specified range of load variation than for optimization with respect to the average efficiency. The relevant analytical expressions derived in the paper are illustrated both graphically and with sample calculations. Figures 2; references: 5 Russian.
[351-8225]

UDC 621.314.26

EVALUATION OF CONTROL CHARACTERISTICS OF FREQUENCY CONVERTER OPERATING IN AUTONOMOUS SYSTEM OF ELECTRIC POWER SUPPLY

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 4, Jul-Aug 81
(manuscript received 23 Dec 80) pp 41-44

MAYBORODIN, B. A.

[Abstract] Use of frequency converters in autonomous systems of electric power supply introduces the problem of more precisely determining their control characteristics. This is explained by the fact that in the type of system under consideration individual regulation of the output voltage of each phase is assured. Use in these systems of synchronous generators with excitation from permanent magnets assumes in general that all the functions of regulation of the output voltage rests on a frequency converter. Consequently, determination of the regulating parameters and an investigation of their effect on the controllability of the frequency converter is necessary for accurate construction of correction systems with the object of a uniform distribution of power during turn on of a frequency converter in parallel operation. For a frequency converter with square-wave modulation of the turn on angle of rectifiers, the characteristics of the control are determined in the present paper with the following assumptions: switching of the rectifiers is instantaneous; the ratio of the input frequency to the output is large. In the type of converter considered, the control parameter is not only the turn on angle of the rectifiers in a rectifying regime α, but also the turn on angle in the inverter regime β. In the general case these angles are not equal. The durations of the rectifier and inverter regimes are also not equal, depending on the nature of the load circuit. The control characteristics of the type of converter in question are investigated and the special features noted are taken into consideration. It is shown that the principal parameter which determines the control

properties of the frequency converter with square-wave modulation of the turn on angle is the turn on angle of rectifiers in a rectifier regime.
Figures 3.
[53-6415]

UDC 621.314.244

USING REGRESSIVE ANALYSIS FOR SUBSTANTIATION OF OPERATIONAL CONTROL AND REJECTION SYSTEM IN PROCESS OF PRODUCING NONLINEAR MEASURING CURRENT TRANSDUCER

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 2, Mar-Apr 81
(manuscript received 18 Dec 79) pp 100-103

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[Abstract] This paper is concerned with substantiation of the method of correcting the tolerances of the basic industrial parameters of measuring current transducers (MCT) on the basis of a multidimensional linear regression. Statement of the problem in such a plan is timely because during production of individual types of nonlinear MCT, as is known from industrial practice, as specified level of technological effectiveness and series fitness is not assured. An algorithm is developed which is readily realized on a computer. A block diagram of the algorithm is presented, and an example of its use is given. It is shown that the proposed method makes it possible simultaneously to conduct an analysis of the information content of industrial parameters and to correct the tolerances for them. During fulfillment of the conditions of corrected norms and tolerances, the device will have a specified level of suitability for series production. The proposed algorithm has a definite generality and consequently it is possible to use the method presented for systems of operational checking and tolerances during production of other manufactured items. Figures 2; references: 5 Russian.
[350-6415]

UDC 621.314.632

BALANCING OF PULSES IN PHASE CONTROL SYSTEM OF THYRISTOR CONVERTER

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 4, Jul-Aug 81
(manuscript received 12 May 80) pp 24-29

ZHUK, A. K. and ISAKOV, S. M., Nikolayev Shipbuilding Institute

[Abstract] The authors consider the problem of developing a method of digital symmetrical synchronization of the phase control system of a thyristor converter, invariant to asymmetry, nonsinusoidalness and the frequency shift of the power supply voltage. The basic circuit is shown of a synchronization unit developed

on the basis of integrated microcircuits of series 140 and 155. The method of calculating the parameters of the synchronization circuit is presented. Figures 2; references: 7 Russian.
[53-6415]

UDC 621.317.382.023.089.68

COAXIAL TRANSDUCER OF DECREASING POWER

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 9, Sep 81 pp 49-52

SERGEYEV, I. A., MIKHAYLOVA, L. S. and NAUMOV, B. I.

[Abstract] A 1975 paper describes a complex of equipment which was developed and investigated so that the uniqueness of measurements of power in coaxial channels could be determined. The Ya2M-21--Ya2M-24 transducers of decreasing power (TDP) which form the basis of this complex are discussed in the present work. The area of application of TDP includes checking of coaxial microwave milliwattmeters and primary measuring transducers, as well as measurement of the amplitiude-frequency characteristics of multipoles (attenuators, dividers, couplers, etc.). A drawing is presented of the Ya2M-21 and Ya2M-22 transducers used in the 3--10 GHz frequency band, and a detailed description of their operation is furnished. With the object of determining long-duration instability of Ya2M-21--Ya2M-24 devices, certifications of eight complexes of devices were made over a period of 5 years with interchecking at intervals of 1 year. The instability of the calibrating coefficient of Ya2M-21, Ya2M-23 and Ya-2M-24 did not exceed 0.5% and the Ya2M-22, 0.8% a year. Use of the technical solutions used in the Ya2M-21--Ya2M-24 transducers makes it possible to create similar equipment for frequencies from 30 to 150 MHz and up to 10 GHz. At present the principal control organs and enterprises of the country are equipped with Ya2M-21--Ya2M-24 devices. Production of the devices has started at the Gor'kiy "Etalon" Plant. Figures 2; references: 11 Russian.
[18-6415]

UDC 621.317.725

ANALYSIS OF DYNAMICS OF INTEGRATING 'VOLTAGE--INTERVAL OF TIME' CONVERTERS WITH INTERMEDIATE SCALE-TIME CONVERSION

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 6, Jun 81 (manuscript received 21 Apr 80) pp 16-21

ZHURIN, A. A., Penza Polytechnical Institute

[Abstract] One of the structural methods of increasing the metrological characteristics of integrating 'voltage--interval of time' converters is the

use of intermediate scale-time conversion. As shown in a 1979 paper by the author of the present work, the essence of the method involves reduction in time of the integral value of the magnitude converted, with subsequent conversion of it into an interval of time. A block diagram is presented of one of the variations of realization of the method in question. Also shown is a time diagram of the converter's operation. The optimum relations needed to assure maximum speed of operation are derived. As compared with the known integrating quasi-scanning converter, the converter under consideration attains the condition of minimum duration of a transient process by simpler means. The paper was recommended by the Department (Kafedra) of Information-Measuring Technics, Penza Polytechnical Institute. Figures 2; references: 4 Russian.
[370-A-6415]

UDC 621.318.4:537.528

PULSED ELECTROMAGNETIC ENERGY CONVERSION IN DISCHARGES WHEN USING INDUCTIVE AND CAPACITIVE ENERGY STORAGE DEVICES

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 3, May-Jun 81
(manuscript received 13 Feb 80) pp 8-14

PASTUKHOV, V. N., Nikolayevskiy Shipbuilding Institute

[Abstract] Differential equations describing pulsed energy conversion in an electrical discharge in water and the electrical explosion of conductors, where the latter are used as pulse breakers, are written and solved. A BESM-4M computer programmed in ALGOL was employed. In contrast to previous literature, the equation for the energy balance in the discharge channel takes into account the Joule heating expended not only for the change in the internal energy of the plasma and the work of widening the channel, but also the energy losses from the channel by radiation which are substantial, even at rather low temperatures. A model for the electrical explosion of a conductor is proposed which explains the threshold energy of the explosion and the anomalous resistance of the conductor; it also models the break in the trailing edge of the current pulse. A comparison inductive and capacitive storage devices based on the computer model for specific circuit parameters (V_0 = 5 KV, L = 1 microhenry, C = 1,000 microfarads and the conductor length is 100 mm) shows that the current maximum for an inductive store is twice that of its capacitive counterpart, while the discharge time is 1.5 to 2 times less. The use of an inductive storage device boosts the rate of channel expansion by an order of magnitude (from 170 m/s to 1,700 m/s) as well as the plasma temperature (from 23,000 °K to 240,000 °K) as compared to the capacitive store for an electrical discharge in water. It is shown that changing the number or cross-section of the conductors can change the characteristics of the electrical discharge in water in a wide range. Figures 3; references: 11 Russian.
[351-8225]

UDC 621.316.54

SWITCHGEAR FOR CRYOGENIC ALTERNATING CURRENT TRANSMISSION

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 7, Jul 81 (manuscript received 3 Feb 81) pp 12-15

LYCHEV, P. V., engineer, Belorussian Order of the Red Banner of Labor Polytechnical Institute

[Abstract] The technical and economical parameters of superconducting cables show that they are competitive with traditional methods of electrical transmission. In the past investigations have been made with respect to connection of superconducting cables into electrical transmission. Ordinary switches can be used with them. However, a combination of superconducting cables one with another with the aid of ordinary switches leads to a double transition of the heat-cold zone by expensive current input devices which provide an additional source of heat. In connection with this, as well as taking into account the possibility of creating an overall system of cold security, which increases the economy of superconducting electrical transmission, it is advisable to use switchgear operating in the cold zone. The present paper describes the design of two such devices and evaluates their characteristics. Cryogenic noncontact switchgear is considered, the operation of which is based on the fact that superconducting materials sharply increase resistance during transition into a normal state. The effect of the parameters of a superconducting material on the technical-economic characteristics of superconducting noncontact switches connected directly into an electrical network is also investigated. One of the possible designs of noncontact switches is illustrated and its makeup and method of operation are described. The paper is presented by the Department (Kafedra) of Electrical Systems. Figures 2; tables 1; references 7; 6 Russian, 1 Western. [51-6415]

UDC 621.317.725

FEMTOVOLTMETER BASED ON JOSEPHSON EFFECT

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 6, Jun 81 (manuscript received 18 Jun 80) pp 7-11

KRIVOY, G. S., Omsk Polytechnical Institute

[Abstract] The paper describes a digital femtovoltmeter used for measurement of direct voltage in the range of 10^{-14}--10^{-11} volt with an error of not more than 10^{-14} V. A block diagram of the femtovoltmeter is shown and explained. A "resquid" is used as a primary measuring voltage-to-frequency converter. This unit is a superconducting circuit of small ($\sim 10^{-9}$ Henry) inductance which contains a Josephson junction and a resistive section of normal metal. Constructively the resquid is fulfilled on the basis of the known two-inductive squid (superconducting quantum interference device), and contains a superconducting (niobium) 10 x 10 mm^2 body with two cylindrical apertures. (A drawing of this unit is shown.) The femtovoltmeter has an input impedance of $3.27 \cdot 10^{-8}$ ohm and a measuring time of 0.21 second. The device is intended for use in cryogenic investigations inasmuch as the resquid operates at the temperature of liquid helium. The paper was recommended by the Department (Kafedra) of Information-Measuring Technics, Omsk Polytechnical Institute. Figures 2; references 9: 6 Russian, 3 Western.
[370-A-6415]

UDC 621.316.722.1:629.113.65

DYNAMIC PROPERTIES OF DISCRETE STABILIZED POWER SOURCE IN ELECTRIC MOTOR CAR

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 4, Jul-Aug 81
(manuscript received 17 Jul 80) pp 36-41

RYCHKOV, V. A., Volga Motor Vehicle Plant, Tol'yatti, GLADYSHEV, S. P.,
Chelyabinsk Polytechnical Institute and SKIDANOV, V. M., Institute of
Electrodynamics, UkSSR Academy of Sciences, Kiev

[Abstract] A block diagram is shown of the stabilized secondary power source of the control circuits of an electric motor car, which is a pulse-duration converter with bilateral pulse-duration modulation of the second kind and with feedback. The converter is connected to the storage battery of an electric motor car, the voltage of which is gradually decreased in proportion to the class of the battery and is changed relatively quickly during operation of an actuator. The converter must have a sufficiently high speed of response in order to finish off the rapid change of voltage of the storage battery (particularly in transitional regimes of the electric drive). Realization of a high speed of response in a converter requires that the discrete nature of its operation be taken into account during analysis. In the present paper an investigation is made of the dynamic properties of the converter by a linear approximation of difference equations. It is shown that with an increase of the amplification factor of the linear continuous part up to the boundary value, the time of the transient process increases. Oscillograms are shown which illustrate the transient process with various values of the amplification factor and the same magnitudes of the assigned signal during a surge and release of the load. The oscillograms presented illustrate well the conclusions in the paper with respect to the nature of the transient processes. Figures 4; references: 1 Russian.
[53-6415]

UDC 621.373.1

PROBLEMS OF DEVELOPING ELECTRIC MACHINE METHODS FOR PULSE POWER GENERATION

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 2, Mar-Apr 81
(manuscript received 31 Jul 80) pp 58-65

LOOS, A. V., Tomsk Polytechnical Institute

[Abstract] Development of efficient methods for power supply of pulse energy consumers with a pulse duration of 10^{-6}--10^{-1} second and a pulse energy of 10^{1}--10^{8} Joule becomes increasingly important in connection with the urgent problems of experimental physics and industrial technology. In order to assure power supply for pulse consumers in a short-duration regime with a comparatively small power of a primary energy source, intermediate energy storage devices based on various principles are employed--mostly capacitance, inductive or inertial. These methods of energy storage are described and current and past development of them is discussed. The areas of preferable use of the electrical machine method for generating pulse power are described. A survey is made of existing types of pulse generators, both in the USSR and abroad. The possibility is considered of using successive switchings of windings to increase the technical-economic indices of synchronous pulse generators. It is considered that there is a promising use and a necessity for further development of methods of electrical machine generation of energy on the basis of the use of complex transient processes. Figures 2; references 23: 19 Russian, 4 Western.
[350-6415]

ELECTROACOUSTICS

UDC 534.8.089.6

CALIBRATION OF ACOUSTIC VECTOR RECEIVERS

Moscow IZMERITAL'NAYA TEKHNIKA No 9, Sep 81 pp 61-64

IVANOV, V. Ye. and KIRSHOV, V. A.

[Abstract] Calibration of vector receivers (VR) involves measurement of the beam patterns and determination of their sensitivity $G_{\dot{x}}$ as regards the oscillatory rate ($G._{\dot{x}}$ = acceleration, G_x = shift, G_p = pressure in plane travelling wave). Because the sensitivity of a VR with respect to the oscillatory rate is connected with the sensitivities $G._{\dot{x}}$, G_x, G_p by the formulas

$$G_x = \omega^2 G_{\dot{x}}., \; G._x,$$

$$G_p = \frac{\omega}{pc} G.._x$$

(where p and c are the density of the medium and the speed of sound in it; ω is the angular frequency), it is advisable to consider the possibility of calibration of VR on a vibration table. This approach makes it possible to give up hydrostands, expensive and complex in operation, or significantly to simplify calibration in comparison with other methods described in the literature. The method of calibrating acoustic vector receivers with the use of a vibration table is described in detail. A typical beam pattern of a VR, obtained at 100 Hz, is presented. Figures 4; references 7: 3 Russian, 4 Western (1 in translation). [18-A-6415]

UDC 534.232

SOUND FIELD OF MOVING SOURCE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 5, May 81 (manuscript received 28 Apr 80) pp 609-620

KRASIL'NIKOV, V. A. and PAVLOV, V. I., Moscow State University

[Abstract] Acoustic phenomena primarily caused by a nonuniform moving soures are considered. Expressions are obtained for the sound pressure which is created by a source moving with an acceleration. The effects connected with the possible cyclic motion of the source are thoroughly analyzed. In this case, expressions are obtained for the radiation intensity. The paper is restricted to consideration of the acoustic effects which originate in the process of excitation of sound under the influence of a thermal mechanism. It is assumed that a change of its phase state does not take place during heating up of the medium by an optical beam. The investigation leads to the limits of a linear approximation with respect to deviations of the acoustic magnitudes from their equilibrium values. These two assumptions limit the intensity of the optical radiation introduced into the medium. It is also assumed, if this is not specified separately, that the sources moves with subsonic velocity, although as close as desired to the velocity of sound. In this case the effects observed will not be masked by the Cerenkov radiation. If the source moves with supersonic velocity, then all the results obtained in the work remain in force (with little change), and only in an expression derived in the present work for pressure does an additional component appear, corresponding to the Cerenkov radiation channel now open. The following points are considered in the work: 1) Basic equations; 2) Acoustic field of source moving with subsonic velocity; 3) Acoustic field far from source; 4) Acoustic field created by point source; and 5) Acoustic radiation with cyclic motion of source. The authors thank V. L. Ginzburg for interest in the work. Figures 2; references: 17 Russian. [375-6415]

UDC 621.372.852

SOME SPECIAL FEATURES IN DESIGNING ACOUSTIC DEVICE FOR DISPLAY COORDINATE METERS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 6, Nun 81 (manuscript received 11 Jun 80) pp 11-16

DZHAGUPOV, R. G., BABAYEV, R. S. and YAKUBOV, R. A., AzSSR Institute of Petroleum and Chemistry imeni M. Azizbekov

[Abstract] Among technical means for processing data presented in graphic form, an important place is assigned to ultraacoustic plotting board coordinate meters. This is explained by their simplicity, reliability, high speed and precision of

measurement. A search for new fields of application for these devices leads to the conclusion that they can successfully be used for encoding television images. In that case the frontal glass bulb of a television display is used. Special features are discussed which supply the specific requirements on the construction of the acoustic device considered in the present work. A drawing is shown of one of the possible variations of an ultraacoustic display coordinate meter, which consists of two piezoelectric radiators, a piezoelectric receiver, a generator of excitation voltage, and a unit for forming coordinate signals. The special feature of the display screen as an acoustic line is its curvature which must be taken into consideration during mounting of the piezoelectric multisection radiators. It is necessary to determine the number of sections on the basis of the permissible length of one section, which is calculated from the condition of its mechanical strength. On the basis of the optical and experimental investigations described in the paper, one of the possible variations of the acoustic device of a display coordinate meter is fulfilled with the use of an ELT-59LKZTs tube. The parameters of the device are presented. The paper was recommended by the Department (Kafedra) of Information-Measuring and Computing Technics, Azerbaijan Institute of Petroleum and Chemistry imeni M. Azizbekov. Figures 2; references 4: 3 Russian, 1 Western.
[370-A-6415]

UDC 533.951

IONIZING DEFORMATION OF PLASMA RESONANCE REGION IN STRONG MICROWAVE FIELD

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 5, May 81 (manuscript received 28 Mar 80) pp 519-523

BAZHANOV, V. S., MARKOV, G. A. and KHAZANOV, I. V., Institute of Applied Physics, USSR Academy of Sciences

[Abstract] The paper presents the results of an experimental investigation of the ionization deformation of the resonance region of a plasma column irradiated by a powerful transverse microwave, and of the oscillations excitable in the plasma and the changes resulting from the phenomena observed concerning the resonance absorption in the column. This work is a continuation of two papers published in 1977 and 1978, of which Bazhanov is the principal author. The new aspects are a qualitative analysis of the oscillations excited in the plasma, which make it possible to evaluate the effect of the turbulence of the plasma on the magnitude of the microwave losses and the special measures with respect to a decrease of the influence of the boundary effects on the nonlinear deformation of the resonance region. This makes it possible to detect the formation in the plasma of the step-profile of density. The following figures are presented: 1) Deformation of density profile of plasma in a transverse microwave field; 2) Spectral characteristic of microwave signal for a mobile probe; and 3) Dependence of relative absorption in the plasma of a resonance column on the power of a decreasing wave. Figures 3; references: 8 Russian.
[375-6415]

UDC 551.510.535

FORM OF SPECTRUM OF NONUNIFORMITIES IN HIGH-LATITUDE IONOSPHERE IN DIRECTION OF GEOMAGNETIC FIELD

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 5, May 81 (manuscript received 7 Apr 80) pp 524-528

YERUKHIMOV, L. M., KOSOLAPENKO, V. I., LERNER, A. M. and MYASNIKOV, Ye. N., Scientific-Research Radiophysics Institute

[Abstract] The authors propose a method for an experimental examination of the form of the spectrum $\Phi_N(\chi)$ of the irregularity of the F-layer of the ionosphere, and, in accordance with the results of observation of the scintillations of the signals of an earth satellite at a frequency of 400 MHz conducted in the region of the Spitsbergen archipelago, it is shown that for 100 m $\lesssim \ell_\perp \lesssim$ 1 km the spectral density has a form close to the equation

$$\Phi_N(\chi) = \Phi_N(\chi_\parallel)\ \Phi_N(\chi_\perp) \alpha |\chi_\perp|^{-p} \exp\left(-\frac{\chi_\parallel^2 \ell_\parallel^2}{4}\right)$$

where $\chi_\perp$, $\chi_\parallel$ are the wave numbers of nonuniformities, respectively, across and along the line of force of the geomagnetic field H. The scale of "cutoff" has the magnitude $\ell_\parallel \approx 5 - 15$ km. The authors express their thanks to A. V. Rakhlin, Yu. S. Korovkov, A. F. Belenov and V. S. Korotkov for their great assistance in organization of the expedition to the Spitsbergen archipelago; A. A. Solonichev who took part in conducting the experiment, and N. N. Novikov for assistance during processing of the data. Figures 4; references 6: 2 Russian, 4 Western. [375-6415]

UDC 551,510.535

MODULATION TRANSFER PHENOMENON DURING EFFECT OF POWERFUL RADIO WAVES ON IONOSPHERE PLASMA

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 5, May 81 (manuscript received 10 Jun 80) pp 529-532

FROLOV, V. L., Scientific-Research Radiophysics Institute

[Abstract] A rapid change of the amplitude of a test wave, i.e., a radio wave of low power with the aid of which sounding of a disturbed region of the ionosphere is performed, brought about by modulation of the radiation power of an excitation wave, was observed in experiments first conducted in the USA with respect to the effect of powerful radio waves on ionospheric plasma. In the present work an analysis is made of the experimental results of an investigation of this phenomena conducted by the author. In addition some of the special features of the phenomena observed in the USA are considered in two Soviet works, one a 1979 paper by the author, where the connection of the phenomena with the

initial stage of evolution of the small-scale stratification of the ionosphere plasma is stated. However, at present a whole series of experimental data still do not have an adequate explanation. Figures 3; references 5: 4 Russian, 1 Western.
[375-6415]

UDC 533.951

PARAMETRIC INSTABILITY OF MAGNETOSONIC WAVES IN PLANE PLASMA WAVEGUIDE

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 5, May 81 (manuscript received 2 Apr 80) pp 533-538

DVORYAKOVSKIY, V. P. and FAYNSHTEYN, S. M., Gor'kiy Polytechnical Institute

[Abstract] The present work is a continuation of a 1979 paper of which Dvoryakovskiy is the principal author. In that paper modulation of the instability of magnetosonic waves in a plane plasma waveguide was thoroughly analyzed. Here, however, the parametric interaction of the normal modes of a system in a magnetohydrodynamic approximation is investigated, during which thermal movement of particles is disregarded. In contrast to the plasma system considered in the 1979 paper, the present work analyzes the case where the permanent magnetic field is perpendicular to the walls of the waveguide. The normal modes of the system are investigated, and a new waveguide mode, corresponding to the special-homogeneous oscillations of the plasma across the magnetic field, is discovered. The possibility is shown of interaction of fields in two cases: a) Interaction of the magnetosonic modes with different transverse indices; and b) Decay of the magnetosonic wave to a packet of the waveguide mode, wide with respect to wave numbers. In an approximation of the specified field, the increment of the parametric instability is found for case a, and a change of the form of the initial pulse for case b. A semiconductor plasma is considered. The authors are greateful to A. G. Litbak, V. O. Rapoport and V. V. Tamoykin for discussion of the work. Figures 3; references 10: 9 Russian, 1 Western (in translation).
[375-6415]

UDC 621.37/39(089.2)

CALCULATION OF THREE- AND TWO-DIMENSIONAL QUASI-STATIONARY AND STATIC ELECTROMAGNETIC FIELDS IN ANISOTROPIC MULTILAYER CYLINDRICAL MEDIA

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 4, Jul-Aug 81
(manuscript received 28 Jul 80) pp 13-17

PREDOLYAK, N. A. [deceased] and KHIMYUK, I. V., Institute of Electrodynamics, UkSSR Academy of Sciences, Kiev

[Abstract] A 1980 work by Predolyak and Khimyuk considers the calculation of quasi-stationary and static electromagnetic fields in isotropic multilayer cylindrical media. In the present paper the authors extend the 1980 work to the case where the conducting and nonconducting layers are characterized by the diagonal tensors of the magnetic permeability $\hat{\mu}$ and the electrical conductivity $\hat{\gamma}$ of the form

$$\hat{\alpha} = \left\| \begin{matrix} \alpha_p & 0 & 0 \\ 0 & \alpha_\varphi & 0 \\ 0 & 0 & \alpha_z \end{matrix} \right.$$

where $\alpha_i = \mu_i, \gamma_i$; $i = p, Q, Z$. In so doing a problem is formulated in the following way: with respect to both sides of the cylindrical surface $\rho = \rho_e$, which contains the source of a field in the form of a double layer of magnetic charges with the functional dependency

$$\mathfrak{M} = M_{mn} \cos \lambda_m z \exp j\,(\omega_n t \mp pn\,\varphi),$$

alternating conducting and nonconducting cylindrical envelopes are located. It is necessary to find the constituent vectors of the magnetic field and the eddy currents. The problem is presented of calculating three- and two-dimensional quasi-stationary and static electromagnetic fields in anisotropic (not isotropic as in the 1980 paper) multilayer cylindrical media. The results of solving this problem can be used as the basis of construction of efficient calculating models of the electromagnetic processes of various electrotechnical devices. The integral characteristics of the field are presented. Expressions which describe the plane-parallel fields are found as part of the case of the general solution obtained. Figures 1; references: 2 Russian.
[53-6415]

UDC 621.318.4

CONSTRUCTING ACTIVE ELECTROMAGNETIC SHIELDS

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 4, Jul-Aug 81
(manuscript received 5 May 80) pp 8-13

BOYEV, V. M., Khar'khov Polytechnical Institute

[Abstract] The problem is considered of shielding several lower spatial harmonics of the field of a source (multipole lower orders of magnitude) which are also decisive in the exterior field of any source. It is shown that use of selective active electromagnetic shields for several multiple sources (mainly of lower orders) considerably simplifies the problem of constructing active electromagnetic shields and in many practical cases satisfies the shielding requirements imposed. The computation data for the shields presented in the work can be used in the process of designing the active and passive shields of various electrotechnical devices (solenoids, transformers, electrical machines and others). Figures 2; tables 1; references: 3 Russian.
[53-6415]

UDC 621.371.167(063)

QUASI-WAVE METHOD FOR SOLVING PROBLEM OF ELECTROMAGNETIC WAVE PROPAGATION IN INHOMOGENEOUS ANISOTROPIC ABSORBING MEDIUM

Gor'kiy IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOFIZIKA in Russian Vol 24, No 5, Mar 81 (manuscript received 10 May 79, after abridgement 20 May 80) pp 649-650

YEVEL'SON, R. L.

[Abstract] A quasi-wave method is developed for solving the problem of electromagnetic wave propagation in an inhomogeneous anisotropic absorbing medium which can be used not only for inhomogeneous quasi-planelaminated media and media with an arbitrary absorption, where the geometrical optics method is inapplicable, but also for transparent quasi-homogeneous media when the VKB (Wentzel-Kramers-Brilbuin) approximation is available, but it is difficult to determine the ray picture of the field (unknown solution of eikonal equation, many interfaces, etc.). During this, in contrast to the conditions of applicability of a geometrical optics approximation, the rate of low-speed changes along the z axis can not coincide with the rate along x and y. References 6: 5 Russian, 1 Western (in translation).
[375-6415]

UDC 621.385.6

INVESTIGATION OF MULTIPLE-RESONATOR KLYSTRONS, OPTIMUM WITH RESPECT TO EFFICIENCY OF OPERATION AND STRUCTURE

Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA FIZIKO-TEKHNICHESKIKH NAUK in Russian No 3, Jul-Sep 81 (manuscript received 21 Jul 80) pp 111-115

AKSENCHIK, A. V., KOVALEV, I. S., KOLOSOV, S. V., KURAYEV, A. A. and SHESTAKOVICH, V. P., Institute of Applied Physics, BSSR Academy of Sciences

[Abstract] In the present paper, the problem is raised of determining the maximum efficiency of six- and eight-resonator klystrons with a number of fixed parameters. In addition the results are presented of an investigation of the dependence of the limiting efficiencies and the optimum parameters of the construction and regime corresponding to them on the current density of the electron beam and the geometry of the gap of the output resonator. The following points are discussed: 1) Special features of the mathematical model of the interaction process; 2) Optimum parameters of six-resonator klystron; and 3) Optimum parameters of eight-resonator klystron. These optimum parameters with various values of microperveance are shown in two tables. A third table represents data on the effect of the width of the gap of the output resonator d on the limiting efficiency of an eight-resonator klystron with microperveance 0.1 and d/a = 2.2 in the resonators of the buncher. Figures 1; tables 3; references: 2 Russian. [50-6415]

RADIO MOSCOW REPORTS SOVIET DEVELOPMENT OF NEW SEMICONDUCTOR PHOTOELECTRIC DEVICE

Moscow RADIO MOSCOW WORLD SERVICE in English 0700 GMT 30 Oct 81

[Excerpts] A series of investigations in solar energy conversion has been carried out at the Physico-Technical Institute of the Soviet Academy of Sciences. The work is seen as hastening the day when solar energy will be running commercial power stations. One of the most promising trends in the effort to harness solar energy involves the use of photo-electric cells based on semiconductors. Work in this field has been underway for a long time.

The scientists at the Physico-Technical Institute have developed a fundamentally new type of semiconductor photo-electric cell. It's a single monocrystal and combines two semiconductor materials - gallium arsenide and aluminum arsenide. Such cells stand up to a light beam with a temperature of up to 1500 degrees Centigrade. The solar beam in these experiments was focused by a spherical mirror on a tiny photo-electric cell, where, in the maze of the crystal structure of semiconductors, it was converted into electricity. The installation yielded 10 watts from a square centimeter of the cell - a good result. Considering the miniature size of the device, the experimenters decided to demonstrate its potential in a somewhat unusual fashion.

The solar energy was used to power an electric shaver which each of the experimenters in turn used to shave. But of course the experiment is really of scientific value. Together with other research in this country, it holds out good prospects for solar energy. Indeed, here is the view of a leading specialist in this field, Dr Nikolay Lidorenko, a corresponding member of the country's Academy of Sciences: [Voice fades to translation.] We believe that by the end of the century advances in semiconducting materials will have made it possible to put solar energy to practical use, and the cost of electricity produced in this way will have been brought down to the cost of electricity generated by hydropower stations. Such forecasts are backed up by the high standards of present-day physics research in the Soviet Union. Long-term plans provide for allocations to build plants for producing the necessary materials. This will pave the way to building solar power stations.

The scientists at the institute are now working on their first big heliopower plant using the new photo-electric cells. It will be a compact system, with mirrors made of metalized plastic. Such an installation will provide the power required by a geological field party, a weather station, a navigation beacon, or water pumps in the country's southern pastures.

CSO: 1860/65-F

GENERAL TREATMENT, INCLUDING POLICY DECLARATIONS, OVERALL STATISTICS, FORECAST OF TRENDS, 'THINK PIECES'

ENSURING TIMELY COMPLETION OF COMMUNICATION INSTALLATIONS

Moscow VESTNIK SVYAZI in Russian No 7, Jul 81 pp 2-4

RAVICH, I. S., deputy minister, USSR Minister of Communication

[Abstract] The present paper gives a lengthy statement of the overall and numerous tasks communication personnel in the USSR are expected to accomplish during the 11th Five-Year Plan. The following are among the tasks assigned. Principal attention is given to the solution of the problem--how is the "Principal directions of economic and Socialist development of the USSR in the years 1981-1985 and in the period up to 1990," as affirmed by the 26th CPSU Congress defined in the section "Capital Construction." At the beginning of this section it is asserted that the principal problem of capital construction is the building up of the industrial potential of the country on a new technical basis, and the building of dwellings and objects of communal-general and Socialist-cultural purposes. Communications personnel of the country who have a particular responsibility will carry out work for fulfillment of the problems advanced by the 26th Congress with respect to further formation of the unified automated communication network of the country (YeASS), the development of television and radio broadcasting, and expansion of the network of municipalities in which channels are installed for transmitting pages of central newspapers by the phototelegraphic method. The new reception points will be installed in Tyumen', Astrakhan, Cheboksar and Arkhangel'sk. Capital investments, material and human resources, as well as technical means are primarily concentrated on starting the most important constructions, first of all for the purpose of increasing the extent of long-distance channels, using cable, radio relay and earth satellite communication lines, not less than 1.8 times over 5 years. Work on the development of telephone communication must always be in the center of attention of supervisors of the respective construction-installation and exploitation enterprises, on the results of the work of which depends the possibility of the installation of residence telephones for more millions of Soviet people. An immediate problem for Construction and Installation organs of Communication is eradication of the substantial losses of working time at construction areas and routes, and a careful relationship to construction machines including transportation means. It is necessary to assure an increase of the working time of the machines. The expenditure of manual labor must be reduced, particularly in laying of cable, earthmoving and loading and unloading work. Officials of all grades have a particular

responsibility for overall utilization of the apportioned completed capital investment, and ensuring from 1981 all the conditions of fulfillment of the construction plan and the introduction into exploitation of each dwelling, children's institution and objects of public health services specified in the plan.
[372-6415]

INSTRUMENTS, MEASURING DEVICES AND TESTERS, METHODS OF MEASURING, GENERAL EXPERIMENTAL TECHNIQUES

UDC 621.375.8

RESOLUTION OF SELF-ADJUSTING OPTICAL DISPLACEMENT METER

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 2, Mar-Apr 81
(manuscript received 18 Dec 79) pp 96-100

KONONENKO, A. G., NIZHENSKIY, A. D., YURCHENKO, Yu. P., ZHUKINSKIY, I. N. and MASYURENKO, Yu. A., Institute of Electrodynamics, UkSSR Academy of Sciences, Kiev

[Abstract] In order to measure the displacement of remote objects, lasers which give an unidirectional monochromatic luminous flux are widely used as a source of radiation. In this case a promising method is also often used, based on modulation of the luminous flux by a continuous microwave signal and measurements of the phase of the envelope signal reflected from the object. The principal problem during the use of such a measurement method is to assure phase identity of the main and reference measuring channels. In order to eliminate errors from nonidentity of the measuring channels it is possible to use an additional circuit for self-adjustment of the value of the difference of the phase shifts introduced by these channels. A functional diagram of an optical displacement meter of this type is presented and explained. The meter has automatic control of the light flux intensity in the reference channel. Consideration is given to the effect on the resolution of the meter of the relatively large level of additive interference caused by the natural noise of the photomultiplier and the device in its output as well as the multiplicitive interference. The optimum parameters are determined for the self-adjustment circuit, with the effect of thermal (white) noise and multiplicitive interference taken into consideration. The conditions are fulfilled for compensation of errors from nonidentity of channels and the random error caused by the multiplicitive and adaptive interference is minimized. Figures 1; references 7: 6 Russian, 1 Western.
[350-6415]

UDC 621.396.004

DIGITAL MODELLING OF INTEGRAL METHOD OF DYNAMIC ERROR COMPENSATION IN THERMAL RADIATION FLOW MEASURING SYSTEM

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian No 4, Jul-Aug 81
(manuscript received 13 May 80) pp 8-13

VERLAN', ANATOLIY FEDOROVICH, doctor of technical sciences, head of department, Institute of Problems of Modelling in Power Engineering, UkSSR Academy of Sciences, Kiev, GERASHCHENKO, OLEG ARKAD'YEVICH, associate member, UkSSR Academy of Sciences, director, Institute of Technical Thermal Physics, UkSSR Academy of Sciences, Kiev, ABDUSATOROV, BAKHROM BORIYEVICH, junior worker, Institute of Problems of Modelling in Power Engineering, UkSSR Academy of Sciences, Kiev, and CHERIN'KO, VIKTOR NIKOLAYEVICH, graduate student, Institute of Technical Thermal Physics, UkSSR Academy of Sciences, Kiev

[Abstract] The time lag of radiation detectors, which is determined by their thermal capacity, limits the possibilities of a system for measuring thermal radiation flows. A large complex of radiant energy detectors developed at the Institute of Technical Thermal Physics of the UkSSR Academy of Sciences, on the basis of sensitive elements of the gradient type are effectively used for investigation of processes, the time for change of which is on the order of 20--30 seconds. Direct use of the responses of these devices for measuring and control of more rapidly changing processes leads to considerable dynamic errors. Methods of compensation for similar errors can be developed by means of a mathematical solution of the inverse problem for equations which describe the processes in the devices mentioned. The authors now consider problems of digital modelling of the process of signal restoration for the purpose of developing algorithms of the functioning of digital special-purpose computer devices, as well as modelling expressions which determine the structure of analogous devices for the same purpose. On the basis of a method of digital modelling an example is solved of compensation for a dynamic error of a concrete detector of radiant thermal flow. A block diagram is presented of an algorithm for solution of an integral Volterra equation of the first kind. Numerical expreiments concerned with the algorithm were conducted on a M-4030 computer according to a program composed in the Fortran-4 language. From the results obtained it is seen that for the class of detector under consideration, the maximum difference of the values of the reducible and actual signal does not exceed 11%, which gives evidence concerning the practical applicability of the method considered. Figures 7; tables 1; references: 10 Russian.
[368-6415]

UDC 621.382

PROPERTIES OF INTEGRATED CIRCUIT COMPONENTS ON BASIS OF GaAs

Moscow MIKROELEKTRONIKA in Russian Vol 10, No 4, Jul-Aug 81
(manuscript received 5 Mar 80) pp 313-320

NEMTSEVA, N. S., NESTEROVA, O. G., SUETINOV, V. I. and STAROSEL'SKIY, V. I.

[Abstract] The paper is concerned with an analysis of the special features of circuit components which are produced in common from epitaxial films of gallium arsenide grown on a semiinsulated substrate. It is shown that by use of a dielectric mask during deposition of the metal barrier contact, it is possible to obtain electrical characteristics of Schottky barriers which are distinguished by the high values of the breakdown voltages and back resistances. Use of one operation of photolithography for opening of windows in the dielectric and metallization makes it possible to realize high-grade barrier contacts with small dimensions. The back resistance of the barrier contacts is $\sim 10^9$ ohm and is determined by leakages through the substrate. The special features of the current-voltage characteristic (CVC) of Schottky diodes, field-effect transistors and resistors are connected with the presence of a section of negative differential conductivity of GaAs, and high mobility of the electrons in weak fields and the large width of the forbidden band. They appear in the saturation current through the diodes and resistors as well as in the unusual behavior of the CVC of field-effect transistors in the mildly sloping region where the output resistance can assume negative values. In many instances these effects are useful, because they make it possible to realize a low-inertia current source, and to protect Schottky diodes from overcharges and increase the amplification factor of field-effect transistors. On the other hand they limit the range of linearity of resistors and establish the possibility of self-excitation of transistor circuits with high load resistances. The dielectric substrate makes it possible in an integrated circuit to form capacitors of small capacitance with a grounded plate. This property of GaAs integrated circuits is very valuable in the microwave band because high-frequency grounding at the surface of a crystal is impossible. Figures 6; tables 1; references 12: 5 Russian, 7 Western.
[338-6415]

UDC 621.382

MODEL OF FIELD-EFFECT TRANSISTOR WITH SCHOTTKY GATE FOR MACHINE PLANNING OF SUPER FAST INTEGRATED CIRCUITS BASED ON GALLIUM ARSENIDE

Moscow MIKROELEKTRONIKA in Russian Vol 10, No 4, Jul-Aug 81
(manuscript received 17 Jan 80) pp 321-326

BUYANOV, N. N. and PASHINTSEV, Yu. I.

[Abstract] The paper is concerned with the development of a model of a field-effect transistor with a Schottky gate based on gallium arsenide, for machine planning of integrated circuits. The method of perturbation theory was used during construction of a dynamic model of the required transistor, and a capacitance matrix was obtained. The dependence of the coefficients of the capacitance matrixes on the voltage is shown. An approximation of the capacitance coefficient of the mildly sloping region of the current-voltage characteristic is proposed. The program of analysis used by the authors was written in Fortran and realized on a computer. In order to illustrate the precision of modelling with the use of the model which they developed and realized, the authors modelled a transient process in a five-stage ring-type generator. The principal circuit is shown of an inverter used during the modelling as well as curves of the results of modelling the transient process. A high degree of agreement between the experimental and calculated time delay is demonstrated. Figures 5; references 6: 1 Russian, 5 Western.
[338-6415]

UDC 621.382

INVESTIGATION OF CHARACTERISTICS OF ANALOG SWITCH WITH MOS STRUCTURE DURING SWITCHING OF HIGH-FREQUENCY SIGNAL

Moscow MIKROELEKTRONIKA in Russian Vol 10, No 4, Jul-Aug 81
(manuscript received 20 May 80) pp 333-338

ZOLOTAREVSKIY, V. I. and POKROVSKIY, Ye. N.

[Abstract] This paper is devoted to an investigation of the characteristics of an integrated MOS-analog switch during switching of a sinusoidal signal with a frequency of 50 MHz and a change of the load resistance from 75 Ohm to 1 kOhm. The most important parameters of an analog switch during switching of high-frequency signals are the values of the attenuation factor, zero in the "switched on" state and infinity in the "disconnected" state, as well as the shift between input and output signals in the "switched on" state. Figures are presented which show the following: 1) Equivalent circuit of a MOS switch transistor in the "disconnected" and "switched on" states; 2) Measuring circuit of the high-frequency characteristics of the switch and the dependence of the attenuation factor in a "disconnected" state on the frequency, with various resistances of the load;

3) Connection diagram of L-shaped and T-shaped switches; and 4) Dependence of attenuation factor in "disconnected" state for self-contained, L-shaped and T-shaped switches. The results of the investigations show that integrated analog switches constructed with MOS transistors, and in particular an eight-channel analog switch, can successfully be used for switching of a high-frequency signal. Switches of complex configuration assure at frequencies up to 50 MHz attenuation exceeding 60 dB in the "disconnected" state, while in the "switched on" state attenuation does not exceed 4 dB (R_{load} = 75 ohm) with a phase shift not more than 25°. Integrated analog switches can also be used for switching of a pulse signal. In so doing, the parameters of the switch can be determined without difficulty by means of an expansion of a pulse into a series of sinusoidal components and the application to the latter of the frequency dependences of the attenuation factor and the phase shift. The data obtained make it possible to assume that on the basis of the technology of MOS transistors with a polysilicon gate and ion doping it is possible to create an analog switch which at a frequency up to 50 MHz (R_{load} = 75 ohm) assures attenuation in a "disconnected" state exceeding 70 dB with an attenuation factor in the "switched on" state of not more than 3 dB and a phase shift not exceeding 25°. Figures 4; tables 2; references 3: 1 Russian, 2 Western.
[338-6415]

UDC 621.382

SPECIAL FEATURES OF PHOTOGENERATION OF CHARGE CARRIERS IN MOS STRUCTURES CLOSE TO EDGE OF METAL ELECTRODE

Moscow MIKROELEKTRONIKA in Russian Vol 10, No 4, Jul-Aug 81
(manuscript received 8 Feb 80) pp 360-364

FROLOV, O. S. and SADOVNICHIY, A. A.

[Abstract] This brief communication considers certain special features of photogeneration of carriers in the case of low temperatures and illumination of the structure as viewed from a metal opaque electrode. Measurements were made at 77 K on varactors produced from KEF-4.5 silicon with a (III) orientation. Thermal silicon oxide with a thickness of 1200-1500 Å grown in dry oxygen served as a dielectric. An aluminum electrode of circular form had a thickness of 1 micrometer and an area of $5 \cdot 10^{-3}$ cm^3. The kinetics were studied on the accumulation of minority carriers in a nonequilibrium biased MOS structure with illumination by an incandescent lamp. A method of investigation of the relaxation processes on the surface of a semiconductor, proposed in a 1969 paper of which Frolov was the principal author, was used for registration of the kinetics. After connection of the voltage, the surface potential of the semiconductor is kept constant at the level of the initial bias by a constant increase of the applied voltage. In the experiments conducted the dependences of voltage on time, V(t), represent the kinetics of the accumulation of photogenerated minority carriers. Two types of V(t) curves were observed. The first shows the dependence of V(t) for specimens of the first type with maintenance of a constant capacitance

of the structure. The second shows the curves V(t) for specimens of the second type. The continuous line is the case of illumination as viewed from the metal electrode; the broken line during illumination from the silicon side. A comparison of the continuous and broken lines makes it possible to conclude that the special features of the continuous curves are connected with the special features of photogeneration of holes close to the edge of the metal electrode. An explanation of these special features is presented. In the course of the experiment, the constant surface potential of the silicon made it possible in a number of cases to simplify considerably the interpretation of the dependences obtained and to observe the special features of the process of accumulation of carriers, not appearing during ordinary organization of a test. It is necessary to consider the special features of the photogeneration of minority charge carriers described above during calculation of the photosensitivity of planar silicon devices containing nonequilibrium biased MOS structures. Figures 5; references 5: 1 Russian, 4 Western.
[338-6415]

UDC 621.382

PHOTOSENSITIVITY OF SURFACE-BARRIER STRUCTURE BASED ON TYPE$^{\mathrm{III}}$B$^{\mathrm{VI}}$ LAMINATED COMPOUND

Moscow MIKROELEKTRONIKA in Russian Vol 10, No 4, Jul-Aug 81
(manuscript received 10 Jun 80) pp 369-371

KYAZYM-ZADE, A. G., SALIMOVA, N. M. and TAGIROV, V. I., AzSSR State University

[Abstract] This brief communication establishes the advisability of using laminated crystals of Type $\mathrm{A}^{\mathrm{III}}\mathrm{B}^{\mathrm{IV}}$ in surface-barrier structures. Their merit lies in the fact that because of the weakness of the interlayer bonds, these semiconductors are readily formed into plane-parallel layers with a thickness on the order of several micrometers or less. In so doing the properties of the film do not differ from the properties of massive single crystals. The concentration of states on the free surface of these crystals does not exceed 10^{10} cm^{-2}, and their surfaces are inert with respect to adsorption of foreign atoms. It is shown that the presence of a surface barrier at the metal-semiconductor contact leads to an increase of the photosensitivity of the base region of a structure with a thin base and to observation of residual photoconductivity at 300 K. The authors thank A. G. Zhdan for helpful discussions. Figures 2; references 9: 6 Russian, 3 Western.
[338-6415]

UDC 621.382

METHOD OF DETERMINING PARAMETERS OF MICROSTRIP UNITS

Moscow MIKROELEKTRONIKA in Russian Vol 10, No 4, Jul-Aug 81
(manuscript received 13 Mar 80) pp 375-379

LIFSHITS, Yu. A., SIMIN, G. S. and KHRUSTALEVA, V. V.

[Abstract] In connection with microstrips (MS) one of the most important problems is measurement of the parameters of the MS of functional units, which in many important cases can be represented by linear two- and four-terminal networks. The principal difficulty in investigating MS units is the obligatory presence in the measuring channel of MS-coaxial or MS-waveguide transitions which make it possible to connect the unit in question with standard measuring equipment. The imperfection of the transitions introduces errors into the results and hinders determination of the actual parameters of the unit in question. The present brief communication presents a simple and effective method which makes it possible to determine the actual parameters of the interlinked MS elements by means of a consideration of the random parameters of the transitions. Figures 2; tables 1; references 7: 5 Russian, 2 Western (1 in translation).
[338-6415]

UDC 535.317.2

LENS FOR REPRODUCTION OF PHASE INFORMATION

Leningrad IZVESTIYA VYSSHIKH UCHEbNYKH ZAVEDENIY: PRIBOROSTROYENIYE
in Russian Vol 24, No 7, Jul 81 (manuscript received 9 Oct 79) pp 91-93

KHVALOVSKIY, V. V., FEDOROV, Yu. V. and FEDOROVA, O. N., Leningrad Institute of Precision Mechanics and Optics

[Abstract] Optical systems of single magnification find an increasingly wider use in systems for processing information, in particular as lenses for holographic memory devices in schlieren projectors for reproduction of phase optical recording (POR), in photolithography, etc. In the present work a lens was designed for a schlieren projector with an amplification (-1^x), a linear field $2-y' = 70$ mm and a numerical aperture of 0.16. At the first stage, the following systems were designed for a minimum of spherical aberration in the region of the third order: joined lens, joined lens in combination with single collecting lens, and two closely positioned joined lens (tandem). Further, a symmetrical optical train was set up and alignment of a system of single amplification with preservation of symmetry was performed. The construction of the optical train and the principal structural design data of the objective for reproduction of POR are presented. Graphs of the aberrations are shown with the operating zone of the pupil divided into two subzones, corresponding to the first and second orders of diffraction. The paper was recommended by the Department (Kafedra) of the Theory of Optical Devices. Figures 2; tables 1; references: 3 Russian.
[52-6415]

UDC 621.380

MULTISTABILITY IN OPTICAL TRANSMISSION OF SPATIAL MODULATION OF LIGHT WITH INTERNAL FEEDBACK

Moscow MIKROELEKTRONIKA in Russian Vol 10, No 4, Jul-Aug 81
(manuscript received 11 Mar 80) pp 373-375

KOMPANETS, I. N., PARFENOV, A. V. and POPOV, Yu. M., Physics Institute,
USSR Academy of Sciences

[Abstract] This brief communication is concerned with a method of creating and investigating spatial bistable optical devices with internal feedback. Such a device is made in the form of a single solid-state multilayer structure and consists of a layer of photoconductor and a thin-film Fabry-Pero interferometer filled by an electrooptical medium--a liquid crystal. Modulation of light is accomplished as a result of orientation of the S-effect in a liquid crystal which leads to a change of its index of refraction and, as a consequence, to a change of the optical length and transmission of the interferometer. Thus the transmission of the interferometer depends on the voltage at the liquid crystal layer, which in turn is determined by the light field passing through the interferometer and partially absorbed in the photoconductor. The feedback circuit is connected up in this way. The authors are grateful to V. V. Titov and V. T. Lazarev for granting liquid crystals and L. M. Blinov, V. G. Rumyantsev, A. A. Vasil'yev and P. D. Berezin for discussions. Figures 4; references: 2 Western.
[338-6415]

UDC 621.314.072.32

PULSE WIDTH MODULATOR DESIGNED AROUND INTEGRATED CIRCUITS

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 3, May-Jun 81
(manuscript received 25 Jun 79) pp 20-24

SELIVANOV, A. I, and LAZAREV, V. A., Moscow, Kuybyshev

[Abstract] The effort to reduce the number of different types of IC'c can necessitate the use of NAND gates for multivibrator design. This paper derives analytical equations and equivalent circuits for a multivibrator with pulse width modulation; the theoretical analysis is checked experimentally against a multivibrator designed around 155LB3 inverters and a few external passive components. The supply voltage is 5 v, output voltage 4 v, the input and output impedances are 10 Kohm and 500 ohm respectively. A graphical comparison of experimental and calculated values shows good agreement. The pulse width modulator has a relatively linear response in a rather wide dynamic range of control voltage change. The dynamic range of the modulation characteristic can be increased somewhat by making the modulator circuitry slightly asymmetrical with an optimal choice of the initial value of the control voltage. Figures 5; tables 2; references: 3 Russian.
[351-8225]

POWER SYSTEMS (INCLUDING EFFECT OF VARIOUS ITEMS ON POWER TRANSMISSION)

UDC 63:621.311-52

COMPLEX AUTOMATION OF RURAL ELECTRICAL NETWORKS

Moscow ELEKTRICHESTVO in Russian No 8, Aug 81
(manuscript received 17 Mar 81) pp 1-6

BUDZKO, I. A., academician VASKhNIL (All-Union Academy of Agricultural Sciences imeni V. I. Lenin), and ZUL', N. M., doctor of technical sciences, Moscow Institute of Engineers of Agricultural Production

[Abstract] The problem has been successfully solved of changing agriculture over to a centralized power supply which required an immense amount of work on the construction of electrical networks, primarily with a voltage of 10 and 0.38 kV, as well as 35-110 and even 220 kV. The length of rural overhead lines exceeds 3.8 million km. In the case of wide electrification of agricultural production, the appearance of such users of electrical energy as cattle-breeding complexes is related to the first category of reliability. The problem of increasing the reliability of the electiical supply acquires an important national economical value. One of the most effective ways to solve this problem is automation of rural electrical networks, primarily networks with a voltage of 6--10 kV. At present a number of organizations (Sel'energoproyekt [Agriculture Power Planning], MIISP [Moscow Institute of Engineers of Agriculture Production imeni V. P. Goryachkin], Mosenergo, Moldavenergo, Bashkirenergo and Lenergo [Moscow, Moldavian, Bashkir and Leningrad Regional Administrations of Power System Management], and others) have developed a large number of different automation devices for rural electrical networks, e.g., relay protection, automatic reclosers, automatic sectionalization, automatic detection and search for failures, control of stand-by and abnormal regimes, and telemechanization of networks. A complex of devices created at MIISP is an example of new developments. They are intended for finding the principal forms of failure in rural networks, transmission of information to a dispatcher point, localization of failure and an increase of electrical security. The basic principles on which this complex of devices is based are listed. Development of a considerable number of automatic devices made possible especially important work on complex automation of networks. However, in spite of the large number of developments, generalized theoretical investigations seriously lag behind with respect to efficiency, possible areas of use of automatic means, and, all the more, optimum solutions of problems of complex automatization. The investigations mentioned

are necessary in order to substantiate the recommendations of industry with respect to series manufacture of the most effective devices and systems of automation, as well as planning and exploitational organizations for acceptance of solutions which assure a maximum effect. Considering that a combination of measures with respect to complex automation of networks in combination with the network itself is an interconnected system, it is advisable for its analysis and synthesis to use the methods of systems engineering, in particular a collection of mathematical models. The following models are described and explained: 1) Model of functioning of signals; 2) Model of system behavior; 3) Time model; 4) Model of system reliability; and 5) Model of effectiveness. In the present paper these models and certain expressions are not considered in detail because for analysis of automatization systems it is advisable to use a combined model of behavior and reliability. The authors stress that taking into acoount the important problems standing before the automatization of rural networks, using the systematic position of the present paper, it is necessary to develop an engineering method of evaluation of the effectiveness of automatization systems, also including other devices (automatic switching reserve, automatic detection of location of damage, etc.), i.e., the total complex of applicable equipment. An appendix evaluates the effectiveness of automation of a 10 kV sectionalized line. References: 3 Russian.
[55-6415]

UDC 621.315.62

CALCULATION OF CROSSTALK ATTENUATION BETWEEN INTRAPHASE CHANNEL AND PHASE-TO-GROUND CHANNEL OF 330 KV POWER LINE

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 3, May-Jun 81
(manuscript received 5 Aug 80) pp 88-93

KNIZHNIK, R. G., PISKUNOV, O. G. and SKRYL', V. F., Kiev Polytechnical Institute, Energoset'proyekt (All-Union State Planning, Surveying and Scientific Research Institute of Power Systems and Electric Power Networks), Kiev

[Abstract] Split phases consisting of two conductors are used on 330 KV power lines; the lines are usually joined together with metal spreaders. If the wires of one phase are held with insulating spreaders, while they are connected together through high-frequency stop band filters at the entrances to substations, a two wire line is obtained which can be used for a multichannel data transmission system. Such a configuration is called an "Intraphase system". A schematic of such a system is drawn and then analyzed in order to derive an expression for the crosstalk attenuation at the near and far ends. The theory was applied to the near and far end crosstalk attenuations for a 61.4 km 330 KV line using 2xASO-300 and 2xASU-300 conductors with a spacing of 9.5 m between the phases, a suspension height of 21.5 m above ground and a spacing between the conductors in each phase of 0.4 m. The specific ground resistance over the power line route was 100 ohm·m in a frequency range of 30 to 500 KHz. The results are plotted graphically showing the near and far end crosstalk attenuation in dB

as a function of frequency: values of 55 to 45 dB decline gradually to 40 to 30 dB for the near and far end attenuations, respectively, between 25 and 500 KHz. Figures 3; references: 5 Russian.
[351-8225]

OPERATION UNDER VOLTAGE--MOST EFFECTIVE METHOD OF 750 kV OVERHEAD LINE OPERATION

Moscow ENERGETIK in Russian No 3, Mar 81 pp 29-31

SEREBRENNIKOV, I. A. and POLEVOY, S. V., engineers, PO Soyuztekhenergo

[Abstract] At present in the USSR most repair and operational work on overhead lines (OL) is carried out with disconnected lines. However, the withdrawal from operation of main lines and intersystem lines of a similar class of voltage in order to fulfill planned work on repair or technical servicing leads to a reduction of the stability of the power system and to other undesirable consequences, e.g., transition to uneconomical operating conditions of electrical stations, limitation of power supply for consumers, increases of losses of electrical power, and so on. The only possibility for preventing losses connected with disconnected 750 kV OL is conducting their repair under voltage. After a discussion of various aspects of the problem, it is shown that in comparison with performance of work with disconnected lines, output of work under voltage on 750 kV OL has the following basic advantages: assurance of optimum operating conditions of power systems and more systematic work of personnel during a year, increase of reliability of 750 kV OL and the power supply of large industrial centers, and reduction of losses of electrical power in networks. Fulfillment of work under voltage on 750 kV OL assures a yearly economic effect of approximately 170 rubles for 1 km of OL, which represents at present, in the case of introduction of this method of work, to an overall economic effect of approximately 300,000 rubles per year. It is necessary to develop and introduce into the power systems of the country the method of work under voltage, taking into account native and foreign experience in operation of lines, in the first place on the main lines and intersystem lines of electrical transmission.
[367-6415]

UDC 621.791.35

LINE FOR SOLDERING RADIO ELEMENTS ON PRINTED CIRCUIT BOARDS BY FLOW SOLDERING

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 81 pp 35-36

SOKOV, A. I. and SAVENKOV, I. V., engineers

[Abstract] At the Special Design and Technological Bureau for Control Computers and at the Orel Control Computer Plant imeni K. N. Rudrev, a line for soldering printed circuit boards with a width of 400 mm has entered into production. The soldering line, as does every typical system of flow soldering, consists of a device for the supply of flux to a printed circuit board in advance of heating of the latter, and a device for flow soldering. The principal part of the system is the conveyer which carrier the board over these devices. The unit is illustrated and its operation is explained. The technical characteristics of the soldering line are as follows: 1) Speed of conveyer in meters/sec 0.01-0.05; 2) Width of conveyer in mm 50-400; Fluxing--foam; 3) Preheating--thermoradiation; 4) Solder--flow solder; 5) Length of solder flow in mm--500; 6) Operating length of flow soldering in mm--400; 7) Power in kW: a). Electrical heating of solder, 9; b. Preheating of electric heating, 4.2; c. Electric motor of pump, 1.1; d. Electric motor of drive, 0.12). 8) Quantity of solder in bath, kg.--350; and 9) Overall dimensions in mm-length, 3235 x 1315 x 1050; control console with base, 690 x 1950 x 1452. Figures 1.
[374-6415]

UDC 535.241.13:534

ELECTRONIC CONTROL UNIT OF DISCRETE ACOUSTOOPTICAL DEFLECTOR

Minsk IZVESTIYA AKADEMII NAUK BSSR: SERIYA FIZIKO-TEKHNICHESKIKH NAUK
in Russian No 3, Jul-Sep 81 (manuscript received 28 May 80) pp 121-124

PILIPOVICH, V. A., SAGAYDAK, V. I., STRUNOV, V. I. and SHCHERBAK, Yu. M.,
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[Abstract] During development of holographic memory devices of large capacity, the problem arises of creating high-speed deivces for arbitrary addressing a laser beam into discrete positions on a plane. An analysis of the characteristics of acoustooptical deflectors points to the possibility of creating acoustooptical deflecting units with the required parameters, which is born out experimentally. In the present work a description is presented of a control unit of a discrete acoustooptical deflector, made on the basis of generators with electronic frequency tuning, and methods for increasing the frequency of the signal generated are discussed. A block diagram of the control unit is presented. It consists of two identical channels, each of which assures forming of a signal of one of 128 discrete frequencies. The electron control unit is made up of six 80 x 140 mm printed-circuit cards and uses 7 W power. In order to obtain an equidistant set of frequencies during a series of changes of the control binary code, a digital-analog converter with individual adjustment of the voltages is used in the control unit. Such a method assures a more precise adjustment of the unit than with the use of linearizing circuits. A functional diagram of the digital-analog converter is presented. Figures 3; references 8: 7 Russian, 2 Western.
[50-6415]

INTERVIEW WITH MIKHAIL AYRAZATOVICH KAZARYAN

Yerevan PROMYSHLENNOST' ARMENII in Russian No 6, Jun 81 pp 35-37

MNATSAKANYAN, L. A.

[Abstract] The USSR State Prize for 1980 in the field of science and technology was awarded to the specialists concerned with the cycle of investigation: "Development of the Physical Principles, Creation and Investigation of Pulsed Lasers Based on Pairs of Metals and on their Basis Optical Systems with Amplification of Brightness." One of the authors of this investigation is Mikhail Ayrazatovich Kazaryan, a candidate of physicomathematical sciences, and a coworker at the Order of Lenin Physical Institute imeni P. N. Lebedev, USSR Academy of Sciences (FIAN). After finishing the Yerevan Middle School in 1964, Mikhail Kazaryan entered the Moscow Physicotechnical Institute (MPTI). Mikhail's diploma work was done at FIAN in the group of Doctor of Physicomathematical Science G. G. Petrazh, where he was concerned with work on lasers based on pairs of metals. In 1975 M. A. Kazaryan defended his candidate dissertation and before long was in charge of a scientific group. To the account of the young researcher there are more than 80 publications and 10 inventions.
L. A. Mnatsakanyan, correspondent of PROMYSHLENNOST' ARMENII, visited FIAN where he met with Kazaryan to discuss the history and substance of "this upheaval in instrumental optics." The material covered in the interview has a fairly low technical level.
[19-6415]

RADARS, RADIONAVIGATION AIDS,
DIRECTION FINDING, GYROS

SECONDARY RADAR SYSTEM PRINCIPLES, IMPROVEMENTS

Moscow GRAZHDANSKAYA AVIATSIYA in Russian No 7, Jul 81 pp 24-25

[Article by V. Trikoz, Ministry of Civil Aviation Radio Electronic Equipment Administration deputy director and State Prize Winner: "Secondary Radar"]

[Text] The basis of all automated air traffic control systems without exception is secondary radar facilities which, among the various facilities for obtaining information on conditions in the air, have, it may be said, acquired supreme importance.

The very principle of secondary radar has been known for a long time--as early as during the Second World War systems for identifying one's own and enemy aircraft were constructed with it. The transmitter of a ground radar sends, in the direction of the aircraft identified, an interrogation pulse, to which an airborne transceiver reacts with a coded response signal. Modern secondary radar systems also operate according to this system. It must be said that at the present time work on their improvement is being carried out quite actively throughout the entire world and already the overwhelming majority of aircraft and ground air traffic control centers have been furnished with secondary radar facilities.

What are the reasons for this so obvious preference given to this method of obtaining information? It is entirely a question of its important advantages. The use of an airborne transponder makes it possible to reduce to a great extent the power of the ground transmitter as compared with a primary radar transmitter making possible the same effective range. The powerful response signal makes it possible to use less-sensitive receiving equipment on the ground and to expand the service area. Finally (and this is perhaps the most important) the signal of the airborne transponder can contain all the additional information necessary for a controller.

However, secondary radar by no means excludes the use of traditional facilities based on the reception of signals echoed from aircraft. Primary radars in fact give a total picture of conditions in the air in two dimensions and they make it possible to represent these conditions clearly on panoramic displays. Therefore systems of both kinds are usually used in conjunction. And in order for their operation to be precise and coordinated, the radar transmitters are switched on in strict synchronization. Matching in terms of azimuth is achieved either by the structural combining of both antenna systems or by using servo drives.

Several types of ground radars having a built-in secondary channel (the "Irtysh," "Ekran," "Onega," "Utes" and "Skala") and the "Koren'-AS" secondary radar are being used at the present time in Aeroflot [Main Administration of the Civil Air Fleet]. The last has two modifications, used both in airfield zones and on airways: built-in and self-contained. This makes it possible to select the optimum variant for combining with a primary radar. When a secondary radar is built into a primary, the accuracy of determining the coordinates of aircraft is improved, the equipment of the complex is made less expensive, and the number of re-echoed signals (noise) is reduced. And the self-contained use of a secondary radar makes it possible to improve the already available inventory of radar equipment.

Transponders have been installed on practically all Aeroflot jet aircraft. In addition to the transceiver and antennas the structure of this equipment includes a coder-decoder. Its job is to recognize and identify the signal of a ground interrogator, as well as to form a response code containing information on the side number of the aircraft, flight altitude, remaining fuel in the tanks, etc. This information arrives from sensing devices on board. For example, altimeters report on the flight altitude. In flight along an airway a report is made to the ground regarding the true barometric altitude, and when in the zone of an airfield, the relative altitude. In any case the error in indication of the altitude by means of ground indicators as compared with airborne instruments is not greater than 40 m.

The information received on the ground, the automatic obtainment of which is made possible by the secondary radar system, after appropriate processing arrives at the controller's console. Information on coordinates is displayed on the screen of the display in the form of a traditional analog marker matched in terms of range and azimuth with the marker of the primary radar. The side number (or individual identification code in the IKAO [International Civil Aviation Organization] system) and the current altitude either light up on a special indicator or are "keyed" in the form of a log on the display's screen to the mark of a specific aircraft.

In order for additional information to be displayed, it is necessary to set the system to automatic tracking. Modern equipment makes it possible to set various operating modes. For example, with the automatic setting all aircraft are tracked which are equipped with transponders and which are in the effective range of the secondary radar system. The maximum number of logs which can be displayed is determined by the capacity of the equipment's channels. Automatic tracking in a zone is distinguished by the fact that in this case only those aircraft are tracked which lie within a specific airspace. The controller can also assign the equipment the task of tracking any single aircraft. For this purpose he enters (by means of a dial) its side number into a storage unit. When the expected aircraft appears in the system's effective range, information on it appears automatically on a panel or indicator. Finally, position tracking is provided for. For this purpose a marker device has been designed by means of which the controller matches the light marker on the display's screen with the aircraft of interest to him.

This ability to select methods of tracking makes it possible to establish the optimum amount of information to be displayed, screening out the superfluous factors which distract one's attention.

Secondary radar systems are constantly being improved. The main ways of developing them further have been determined by the growing requirements for improvement of the precision, noise immunity, resolution, speed of response and operating reliability of automated air traffic control equipment. In the process of improvement it is first necessary to eliminate shortcomings discovered in operation. Let us name the most important of these.

As yet a limited carrying capacity is characteristic of secondary radar. The reason is that each airborne transponder is usually in the "field of view" of several ground interrogators which are not synchronized with one another. Therefore, mutual interference is possible and as a result of this the loss of information. For the purpose of increasing the carrying capacity it is necessary to lower the power of ground interrogators, to use devices for suppressing the side lobes of the beams of transmitting antennas, and to equip transponders with noise suppressing filters.

Another disadvantage of existing systems is their limited resolution. The problem is that when several aircraft strike a single beam of a ground interrogator the superposition of response signals and distortion of the code are possible. The main method of improving resolution while maintaining the existing principles of coding is the optimum distribution of interrogators in relation to airways.

No small concern in the distribution of radars is caused by echoing of their signals from local objects (buildings, hangars, antennas of other radio equipment and the like). In addition to choosing the optimum location for a radar, here it helps to raise the antenna's radiation pattern and to automatically lower the gain of the receiver when the antenna turns in the direction of a re-echoing local object. The latter measure, incidentally, has proven quite effective for the Moscow area air traffic control system.

The elimination of these shortcomings and the further improvement of secondary radar systems obviously must proceed along two lines. The first is the introduction of innovations making it possible to improve the performance of existing equipment. But the root problem of increasing the carrying capacity can be solved only in part by this method. For the complete satisfaction of the information needs of automated systems of the future, development along the second line is necessary, which calls for changing to new more advanced design principles.

One promising new design principle for secondary radar systems is the individual address interrogation of each aircraft. In systems in existence at the present time space indication has been used as the basis: response signals are transmitted by the transponders of all aircraft at which the beam of the radar interrogator is aimed. With individual interrogation each aircraft is assigned its own address code (number) to which the airborne transponder responds. Conversion to the address mode of operation not only makes it possible to eliminate practically all limitations and shortcomings, but in addition solves a number of problems relating to guaranteeing the safety of flights, in particular, of constructing a system for warning of the dangerous approach of aircraft to one another and of creating a high-speed "ground-airborne-ground" data transmission line.

The amount of information which can be transmitted by the transponder can be increased considerably in proportion to the development of airborne piloting and navigation equipment.

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CSO: 1860/349

UDC 519.8

COMPARISON OF RECURRENCE-TYPE ALGORITHMS OF NONRETRIEVING CORRELATIONAL-EXTREMAL NAVIGATION SYSTEMS

Moscow IZVESTIYA AKADEMII NAUK SSSR: TECHNICHESKAYA KIBERNETIKA in Russian
No 4, Jul-Aug 81 (manuscript received 5 Sep 80) pp 58-67

KRASOVSKIY, A. A. and CHIGIN, G. P., Moscow

[Abstract] Two methods of synthesizing discrete suboptimal algorithms of nonlinear estimation of continuous processes such as navigation processes are compared with regard to convergence and accuracy. One method is based on using a natural model of the process and natural conditions of measurement, with the corresponding ordinary matrix differential equations transformed to Euler difference equations through numerical integration. Another method is based on the immediate use of a discrete model and proceeding from there in any of various possible ways. Both methods are employed in correlational-extremal navigation systems, where retrieval of information is not a primary task, the simplest of such systems being one where only two components of the track velocity are measured and only one field is controlled. The first method leads to recurrence-type algorithms based on a first-approximation nonlinear Karman filter or on continuous invariant submission, respectively. The second method leads to recurrence-type algorithms based on the maximum likelihood or also on continuous invariant submersion. The results of numerous simulations, with white noise assumed to be present in each case, reveal a close analogy between estimation processes with these different algorithms in this particular application. Figures 6; references 4: 3 Russian, 1 Western (in translation).
[28-2415]

UDC 531.383

USING TWO-STEP STABILIZATION IN OPTICAL DIRECTION-FINDING DEVICES

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian
No 6, Jun 81 (manuscript received 7 Jan 81) pp 58-63

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[Abstract] In optical direction-finding devices, operating on a mobile basis, stabilization of the image in the focal plane of the objective is necessary. The basic group of perturbations leading to smearing of the image includes looseness and vibration of the base, as well as natural oscillations of a stabilization system. The use of systems of power gyrostabilization in optical direction finders is limited because of the nutation inherent in them which deteriorates the quality of stabilization, as well as because of the large overall dimensions. In systems of indicator stabilization it is difficult to assure a high quality of stabilization because of the very rigorous requirements on the speed of response of the operating electric drive and on the parameters of the dynamics of control circuits. A promising method of improvement of the characteristics of the indicator gyrostabilizer optical device is the use of a two-step stabilization circuit. In the present work some aspects are considered of the construction of such a two-step indicator gyrostabilizer (TSS) for stabilization of the sighting line of optical direction-finding devices. A functional diagram of a one-coordinate TSS, a block arrangement of a TSS which includes an amplifier, a control device, a stabilizer motor, a reducer, a piezoelectric drive, an attitude sensor, and a unit for duplicating an angle, and a block diagram of another TSS are presented. The paper was recommended by the Department (Kafedra) of Airborne Control Devices, Leningrad Institute of Precision Mechanics and Optics. Figures 3; references: 2 Russian.
[370-A-6415]

UDC 62-501.72

IDENTIFICATION OF NONLINEAR OBJECTS WITH NOISE

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 8, Aug 81
(manuscript received 19 Sep 80) pp 46-55

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[Abstract] The present paper is concerned with the following objectives:
1) Development of criteria which make it possible to determine the fact that an identifiable object belongs to a class of systems which contains a nonlinear inertialness converter, the operator of a time shift and the source of an additive separate noise; 2) Determination for systems of the class mentioned of a definite form of the principle of a functional conversion by an object of a valid input

signal and its delay, as well as the form of the effect of the input signal on the output signal of the object; and 3) Evaluation for a system of the class mentioned of the intensity of the noise and the degree of connection of the input and output signals. A theorem and the consequences from it are proposed, which can be used as a basis for solution of the problems formulated above. The theorem makes it possible to determine the possibility of presentation of the structure of an unknown object which is described by one of the most general circuits shown in the paper as Figure 1, in the form of the block diagram of Figure 2, and the results assure determination of the principal characteristics. In so doing a number of initial conditions listed in the paper are assumed to be valid. A long appendix considers the basis of the theoretical results and an example is given of the use of the method of identification considered. Figures 2; references 6: 4 Russian, 2 Western in translation.
[54-6415]

UDC 621.384.32

DETERMINATION OF SIGNAL FORMS REFLECTED FROM COMPLICATED OBJECTS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: PRIBOROSTROYENIYE in Russian No 6, Jun 81 (manuscript received 4 Jan 80) pp 78-83

ARZHANIKOV, Yu. N., LEBED'KO, Ye. G., TIMOFEYEV, O. P. and YAKOVLEV, A. S., Leningrad Institute of Precision Mechanics and Optics

[Abstract] The authors developed an automatic electrooptical device which registers element by element the amplitude-time structure of a signal reflected from the model of an object. In combination with a computer, it is possible completely to automate the process of obtaining amplitude-time characteristics of signals without intermediate calculation of the pulse response of the object. The device, a block diagram of which is presented, consists of four units: a radiator with a high-frequency modulator, a sweep unit, a receiving device, and a unit for control and processing of information. A LG-56 laser is used as a radiation, the use of which makes it possible to conduct a discrete survey without overlap of neighboring zones with respect to all the depth of the space in question. The ML-3 electrooptical modulator is intended for high frequency modulation of laser radiation (at a frequency of 36 MHz). Use of this automatic electrooptical device in combination with a computer makes it possible to obtain the statistics of signals reflected from detection and ranging objects of complicated configuration for any source of pulse radiation with a minimum difficulty without intermediate calculation of the pulse response of the objects. The paper was recommended by the Department (Kafedra) of Opticoelectronic Devices, Leningrad Institute of Precision Mechanics and Optics. Figures 2; references: 8 Russian.
[370-A-6415]

UDC 621.391.1:519.27

SEARCH FOR MOVING SIGNAL IN MULTICHANNEL SYSTEM BY DEGENERATED SEQUENTIAL ANALYSIS METHOD

Moscow PROBLEMY PEREDACHI INFORMATSII in Russian Vol 17, No 2, Apr-Jun 81 (manuscript received 10 Apr 80, after revision 14 Oct 80) pp 69-74

TERPUGOV, A. F. and TONKONOGOV, Yu. M.

[Abstract] The problem of search for a signal in a multichannel system occurs in a number of communication and radar technology problems. The optimum algorithm of search for a signal is the algorithm proposed and investigated by K. Sh. Zigangirov in 1963 and 1964 papers. A sufficiently good approximation to this optimum algorithm is an algorithm for sequential scanning of the channels with the use of degenerated sequential analysis, during which in the limiting case of similar hypotheses, both these algorithms coincide. However, the characteristics of these algorithms are only obtained for a stationary object, although in a number of situations it is necessary to be concerned with a signal moving from one channel to another. The present paper gives the characteristics of an algorithm of sequential scanning of channels with the use of a degenerated sequential analysis for a signal moving with respect to channels in the cases of Markov and recurrent models of its movement. The following items are considered: 1) Description of system; 2) Average acquisition time with Markov model of signal movement; 3) Distribution of probabilities for acquisition time with Markov model of a signal movement; 4) Control of parameter μ as a means of acceleration of acquisition of moving signal; and 5) Average acquisition time of moving signal with recurrent model of its movement. Figures 1; references 8: 7 Russian, 1 Western in translation.
[369-6415]

SEMICONDUCTORS AND DIELECTRICS, CRYSTALS IN GENERAL

UDC 531.781.2:621.315.002

USING VITREOUS DIELECTRICS IN HIGH-TEMPERATURE RESISTANCE STRAIN GAUGES

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 7, Jul 81 pp 32-34

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[Abstract] At present, cases are known of the use of vitreous dielectrics (glass and glass cement [prestressed fiberglass-reinforced cement]) for fastening semiconductor resistance strain gauges (RSG) to transducers of mechanical parameters, and in the process the advantages of this technology over organic materials and cements were demonstrated. However, information concerning fastening of foil RSG to elastic elements with the aid of vitreous dielectrics did not exist, which is explained by the lack of the necessary vitreous dielectrics, satisfying a number of specific requirements, and by technological difficulties. In connection with the promising future of the above method, the authors conducted investigations with respect to its effectiveness, as a result of which a new type foil RSG was created--on a vitreous dielectric substrate. The results obtained from the investigations show the advisability of using the proposed technological process for creation of RSG operating up to a temperature of 250°C with a basic error of 0.5%. A further improvement of the metrological characteristics of RSG is possible by means of a decrease of the imperfections of the elasticity of the material of the elastic elements. The investigations conducted also make it possible to speak of the promising future for use of vitreous dielectrics in the creation of high-temperature foil RSG for fulfillment of strength investigations. Furthermore, the technology described in the paper is useful for production of high-temperature stable foil resistors for general technical use. Figures 4; references: 7 Western (3 in translation).
[374-6415]

UDC 621.315.61:538.13:621.317.41.087.92

LATERAL MAGNETOTRANSISTOR WITH METAL-INSULATION-SEMICONDUCTOR STRUCTURE

Moscow IZMERITAL'NAYA TEKHNIKA in Russian No 9, Sep 81 pp 58-60

RAGAUSKAS, A. V., MANYUSHITE, V. Yu. and SHLITERIS, R. Z.

[Abstract] Magnetotransistors based on galvanomagnetic-recombination (or magnetoconcentration) effects in semiconductors close to the characteristic type of their conductivity are studied in a number of countries. Field effect magnetotransistors with the structure metal-insulation-semiconductor-insulation-metal (MISIM) differ from other types of magnetotransistors by wide functional possibilities. Known designs of field effect MISIM magnetotransistors, in which field effect electrodes are located on two narrow facets of a semiconductor wafer, are poorly compatible with contemporary microelectronics technology. This leads to a complex design of magnetomeasuring probes and a time-consuming process in their production and adjustment. In the present work, a new lateral magnetotransistor structure is presented and described, which has field effect current electrodes located on one wide facet of a semiconductor. Such a structure is produced with the use of planar technology. The principles of action of a lateral MIS magnetotransistor is based on the use of an average concentration of current carriers in the semiconductor, with a simultaneous action of three fields: magnetic, longitudinal electric and transverse electric. The circuit diagram is presented and explained of a field effect MIS magnetotransistor used as a measuring transducer of magnetic quantities. Theoretical and experimental investigations of the linear galvanomagnetic effects in lateral magnetotransistor structures are described. It is concluded that the lateral structure, with allowance made for its technological effectiveness, makes the MIS magnetotransistors promising devices for construction of multifunction electrical controllable magnetomeasuring transducers. Figures 2; references 8: 5 Russian, 3 Western.
[18-6415]

UDC 518.9

ALGORITHM OF SEARCH FOR MINIMUM OF FUNCTION OF TWO VARIABLES WITHOUT CALCULATION OF ITS DERIVATIVES

Moscow IZVESTIYA AKADEMII NAUK SSSR: TEKHNICHESKAYA KIBERNETIKA in Russian
No 4, Jul-Aug 81 (manuscript received 5 Jan 81) pp 68-78

KOROTCHENKO, A. G., Gor'kiy

[Abstract] Problems of two-dimensional optimization require minimization, by numerical methods, of a function of several variables at one point. Such methods will be efficient only if the algorithm involves calculation of the function alone, without calculation of its derivatives. Several such algorithms have already been proposed. Here one is proposed where the region containing the minimum is stepwise decreased in the locating process. The algorithm is constructed for a function of two variables in the class of functions continuous and differentiable on a convex closed and bounded set, specifically a function strongly convex and thus having only one minimum on any segment of this set. The algorithm is applied to a square set and the process of square reduction is followed through, considering all four possible situations where maxima of the function occur at corners of a square and all four possible relations between values of the function at points on an extension of one side of a smaller square and its values at points on a straight line through the center of that square. The results obtained here are also valid for a larger class of functions with the given properties. The author thanks F. L. Chernous'ko, A. I. Ovseyevich, D. B. Yudin and A. S. Nemirovskiy for the helpful suggestions. Figures 5; references 14: 8 Russian, 6 Western (one in translation).
[28-2415]

UDC 537.523.4

DETONATION MODEL OF PULSED ARC IN SIMILARITY MODEL APPROXIMATION

Kiev TEKHNICHESKAYA ELEKTRODINAMIKA in Russian No 3, May-Jun 81
(manuscript received 28 May 80) pp 67-75

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[Abstract] The discharge of a pulsed arc in a gas can be treated as having two stages: one in which the shock wave front is not yet detected and a second when the shock wave front has separated from the discharge channel boundary. In the initial stage, the rate of channel expansion can run around 10 km/sec and the front can in no way be the physical reason for plasma propagation. The plasma propagates in this first stage as a thermal wave through the unperturbed gas at a velocity exceeding the shock wave velocity. The Joule energy of the longitudinal arc current is transported to a considerable extent by the radiative thermal conductivity flux to the channel boundary, with absorption in the cold gas layer, its subsequent heating to the ionization temperature and the propagation of the longitudinal current to the heated layer. Such a supersonic radial plasma propagation mode through the cold gas governs the transport of a cold particle through the front, with heating and compression. The fact that the thermal wave velocity is a sharp function of temperature with the further drop in the plasma temperature leads to the separation of gas particles from the channel boundary in the second stage of the process. The mass velocity of the particles is greater than the speed of sound in the cold gas, i.e. gas motion should be described by the shock wave characteristics. This physical model is reduced to a formal mathematical statement based on a similarity analysis of gas dynamics equations in a homothermal approximation for the discharge channel region. An analytical expression is derived for the radius of a pulsed arc channel in the nanosecond range as a function of time; good agreement with experimental data is noted. The expressions can predict the temperature and pressure as a function of time; the conditions limiting the applicability of the approximations are discussed in light of specific discharge parameters with sample calculations. Figures 4; references: 11 Russian.
[351-8225]

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Dec. 23, 1981